ERRATA.

The reader is requested to note the following corrections of errors in part of Chap. XVI, which was inadvertently printed off before the revised proofs were received from the author :—

Page 251, line 5, after *ever*, insert *in other cases.*

Page 254, line 1, dele *of which.*

Page 256, line 25, transfer the sentence in parenthesis to the following line but one, after *not so.*

Page 264, line 9, for *cherished*, read *cultivated.*

Page 280, line 4, for *language*, read *them.*

Page 283, line 1, for *both*, read *with.*

—— line 3, dele *thus providing.*

A TREATISE

ON THE

CLIMATE AND METEOROLOGY

OF

MADEIRA.

A TREATISE

ON THE

CLIMATE AND METEOROLOGY

OF

MADEIRA;

BY THE LATE J. A. MASON, M.D.

INVENTOR OF MASON'S HYGROMETER;

EDITED BY

JAMES SHERIDAN KNOWLES.

TO WHICH ARE ATTACHED

A REVIEW OF THE STATE OF AGRICULTURE AND OF THE TENURE OF LAND;

BY GEORGE PEACOCK, D.D., F.R.S., &c. &c.

DEAN OF ELY, AND LOWNDEAN PROFESSOR OF ASTRONOMY IN THE UNIVERSITY OF CAMBRIDGE;

AND

AN HISTORICAL AND DESCRIPTIVE ACCOUNT OF THE ISLAND, AND GUIDE TO VISITORS;

BY JOHN DRIVER,

CONSUL FOR GREECE, MADEIRA.

LONDON: JOHN CHURCHILL.

LIVERPOOL: DEIGHTON AND LAUGHTON.

M.DCCC.L.

"NAM'D FROM HER WOODS, WITH FRAGRANT BOWERS ADORN'D,
FROM FAIR MADEIRA'S PURPLE COAST WE TURN'D;
CYPRUS AND PAPHOS' VALES THE SMILING LOVES
MIGHT LEAVE WITH JOY FOR FAIR MADEIRA'S GROVES;
A SHORE SO FLOWERY, AND SO SWEET AN AIR,
VENUS MIGHT BUILD HER DEAREST TEMPLE THERE."

The Lusiad.—Book V.

LIVERPOOL:
PRINTED AT THE MAIL OFFICE, SOUTH CASTLE-STREET.

TO

SIR JAMES CLARK, BARONET,

F.R.S., Etc., Etc.

Sir,

Besides the consideration due to you, on account of your eminent professional rank, both as a practitioner, and as a contributor to medical science; your personal acquaintance with the late Dr. Mason, the author of the present work, and the fact of his having prosecuted his enquiries with your encouragement, and, in a great measure, under your direction; points to you as the proper person to whom it ought to be Inscribed.

The dedication has, accordingly, been placed at your acceptance; in granting which, you have done honour to the memory of an accomplished, talented, and zealous member of the profession; and conferred upon one, who is a perfect stranger to you, an obligation which is most respectfully and cordially acknowledged by,

Sir,

Your most obedient humble Servant,

JOHN DRIVER.

Egremont, near Liverpool,
1st March, 1850.

PREFACE.

Apart from the value of Dr. Mason's work, as affording a just estimate of a climate, the resort of a particular and large class of invalids; his labours acquire an interest from the fact of their having been prosecuted in a state of extremely infirm health, regardlessly of the influence which they must have had in aggravating the symptoms and lessening the chance of recovery. He may be truly said to have sacrificed his life to professional zeal. Contending with an extensive derangement of the pulmonary functions, he resolutely cast aside all solicitude for his own health; and, without intermission or pause, completed a series of difficult and fatiguing obser-

vations, with the noble view of rendering a benefit to society. The exposure and privations which he would have imperatively prohibited a patient from encountering, he fearlessly and enthusiastically contended with, in his own person; undeterred by the most trying fluctuations of temperature, the prostration attendant upon a constant strain of the mind, and the watching which broke in upon that ordinary rest which even the robust cannot forego, without some degree of suffering. To none would he for a moment depute the task which he had undertaken; and, when all around him were enjoying repose or courting it, this martyr, as he may be called, to meteorological investigation, passed the night with his instruments and journal; noting down the minutest change which the atmosphere underwent, from the first sinking of the sun to the first indication of its rising.

Nor was this the fanaticism of unfounded self-reliance. Dr. Mason had commenced his medical studies in Paris; and had prosecuted them, sedulously, there, during a period of three years, previously to his entering the University of Edinburgh, where he took his degree. So thorough a course of training, with a temperament so sanguine; and

with a spirit of application so determined, as to be reckless of lets and consequences; could not fail to produce a Physician of no limited or ordinary professional accomplishments.

His visit to Madeira, and consequent residence there, for a period of nearly two years, were purely accidental. When the first symptoms that threatened his life, became apparent to him; he was recommended, by Sir JAMES CLARK, whom he consulted, to repair to Nice. Accompanied by Mrs. MASON, he crossed to Dieppe, whence it was his intention to reach Italy, by land. This object, however, was unfortunately frustrated, by that utter disregard of self, which seems to have formed the leading feature of his character. Upon arriving at Dieppe, a relative, who had joined the party, was attacked with brain fever; and, for six weeks, without intermission, did Dr. MASON watch by the bedside of his friend, whose recovery to a state of almost perfect convalescence* was the reward of this devotion; but at the cost of abandoning, upon the part of him who had displayed it, an object,

* Notwithstanding this favourable issue, where the worst consequences were anticipated; an incautious, slight indulgence, after Dr. Mason's departure, induced a relapse, which unfortunately terminated in death.

which might have been productive of the most beneficial results. Seven weeks had now elapsed; the favourable season for a visit to Nice was lost; and a communication from Sir JAMES recommended a change of destination in favour of Madeira.

Having here completed the present work, after a residence of one year and ten months, he, at length, determined upon repairing to Nice; the climate of which, as he had been always persuaded, was far better adapted to his case. This step, had it been taken at an earlier period, and in the proper season, might have ultimately led to his recovery; but, intent upon bringing to a close, a work, which, with a due regard for his own safety, he ought never to have commenced; and the fatigue and exposure of perfecting which had a tendency to place his complaint beyond the succour of remedy; the hopeful hour had gone by; and the Italian sun, from whose influence he, even now, anticipated relief and renovation, was destined to bestow no other smile upon him than that which it cast upon his grave!

The only mode of leaving the Island was by a vessel bound to England, whence, after a short stay,

Dr. Mason and his lady embarked for Havre. Proceeding from Havre towards Nice, partly by land, and partly by river conveyance, they reached Avignon, where they took the diligence, without being aware that there would be no stoppage on the road for refreshments. Some fruit and bread, accidentally provided, was the only subsistence for four-and-twenty hours. They arrived at Nice as dinner was serving up; but scarcely had they sat down to it, when Dr. Mason felt himself compelled to exchange the table for his bed, to which an attack of dysentery confined him from that moment, until, after the lapse of a fortnight, his death took place in the twenty-seventh year of his age.

By the direction of his friend, Sir James Clark —to whom, at the commencement of the attack, the probability of a fatal issue was communicated by the Medical attendant, Doctor Bowling,— his body was opened, when it was found, that, though the lungs were seriously diseased, the state of those organs did not preclude the probability, that life might have been preserved for yet some four or five years—a term which, it is regretful to reflect, might possibly have been doubled, if not extended even to the ordinary span, had not the

ardour of scientific investigation, superseded the solicitude which was due to the love of life.

His work, the property of his relict's second husband, is now presented to the public. The sacrifice at which it was executed has been thus truthfully recorded—its merits are left to speak for themselves.

Acknowledgments are most cordially rendered to the Very Reverend the Dean of Ely, for his valuable and able contribution, as well as to Charles McEuen, Esq., of Philadelphia, and to J. A. Young, Esq., of London, for the respective registries of their Meteorological Observations, in the same locality.

CONTENTS.

LIST OF PLATES.

PART I.

METEOROLOGY

OF

MADEIRA.

BY J. A. MASON, M.D.

METEOROLOGY OF MADEIRA.

CHAPTER I.

MANNER IN WHICH THE OBSERVATIONS WERE MADE; COMPARISON OF THE HYGROMETER BY EVAPORATION, AND SIR JOHN LESLIE'S; OF THE AMOUNT OF VAPOUR IN THE ATMOSPHERE OF LONDON AND MADEIRA.

In offering the following observations on the climate of Madeira to the public, it is necessary, first, to state the precise manner in which they were obtained, in regard of time, topographical situation, and the character, and local position, of the instruments.

In respect of Time.—The observations were commenced on the 1st of March, 1834, and ended on the 28th of February, 1835.

With regard to Topographical Situation.—Sta. Luzia Cottage is situated on the Mount road at a rather abrupt rise from Funchal, on the brow of a valley lying between two ravines. Its distance from the sea is about half a mile due north; and its

height above the level of the sea three hundred and fifty feet.

The position of the Instruments.—The register thermometer, for the external temperature in the shade, was fixed in the garden four inches from a stone pillar, one foot square, with a room above it—the pillar being one of the supporters of the floor—free from currents of air, and reflected light, though exposed to radiant heat, and receiving the sun's rays obliquely from 2 p.m. to 5 p.m.; the thermometer obtaining its maximum from half-past 2 to 3 p.m.—aspect N.W. by compass. The register thermometer for the shade indoors was situated in a sitting-room to the east, on the S.W. wall, by compass; a closet, four feet square, intervening between the thermometer and external wall of the house. This thermometer was subject to reflected light from the oil-cloth on the floor and the opposite wall—whitewashed—from 9 a.m. to half-past 11 a.m.; maximum temperature about 2 p.m. Both thermometers were surrounded with a fold of white writing paper. The intensity of the sun's rays was ascertained by placing a thermometer of large range, having its bulb covered with black wool, on the mould in the garden, with a full exposure to the sun from 9 a.m. to 5 p.m. The thick wooden frame in which the thermometer was placed rested upon the ground, but the bulb, with the wool intervening, might be about an inch distant. This arrangement was by no means unobjectionable; but the irregularities to which it was liable were in

a great measure balanced by the multitude of observations.

The hygrometer was situated in a room to the west, between two windows constantly open from 6 a.m. to 6 p.m., and very free from currents of air, as they acted like folding-doors. This room was, consequently, free from local humidity, arising from the evaporation of water from the ground, &c.

The winds were determined by a vane in the garden, placed upon a high flag-staff, and registered by the compass.

The few observations on radiation were taken from the thermometer, which registered the intensity of the sun's rays; and, in the same situation, a register spirit-thermometer, the bulb covered with black wool, was placed on a stool six inches from the ground, in the same exposure, with the view of obtaining the maximum intensity of terrestrial radiation.

Instruments employed.—The temperature in the shade, outdoors and indoors, was ascertained by Cary's improved horizontal register thermometer; and the intensity of the sun's rays, by a thermometer made by Ortelli, Baserga, and Co.—the mercury of which flowed freely along the tube.

The diameter of the bulb was $\frac{6}{10}$ of an inch, the boiling and freezing points being marked on the tube. Length, from bottom of bulb to 212°, 12 inches; from 32° to 212°, $9\frac{8}{10}$ inches.

The thermometer, of which the hygrometer was constructed, was one of Stebbings', Portsmouth; the

diameter of the bulb was $\frac{4}{10}$ of an inch; the length, from 0° to 130°, $4\frac{3}{10}$ inches.

The corresponding thermometer, to register the heat of the air, was made by Tarelli, Northampton; diameter of bulb, $\frac{25}{100}$.

All the thermometers registered the same degree under similar circumstances within .250 of a degree, which in taking the observations was allowed for. They were examined; first, after remaining suspended in the centre of a large room for four hours, the light being excluded; secondly, after remaining three hours exposed to a clear sky, from 8 p.m. to 11 p.m.

The theory and uses of my hygrometer, with a description of the instrument, will be found in the "Records of General Science," vol. IV., pages 23 and 96.

I need only observe, here, that the principle of this method of registering the humidity and dryness of the atmosphere was first pointed out by the late Dr. James Hutton; and that the results are as unexceptionable as those obtained by any of the dewpoint hygrometers, while the instrument is of much easier application. I will not enter now into the views which I have been led to adopt with regard to the theory of the instrument, and the method of finding the absolute dryness or dewpoint, as it would be foreign to my present purpose; moreover, to avoid the possible errors of theory, I have registered the observations solely by the difference of temperature, indicated between the wet and

dry bulbs of the thermometers; and added a Table of Reference, shewing the comparative degrees of the dewpoint hygrometers, or of absolute dryness existing on the scale of Fahrenheit's thermometers; as well as the degrees on Sir John Leslie's hygrometer, for comparison with the degrees, observed on my own.

As my views may not, at present, meet with general sanction, I shall compare the hygrometric observations made at Madeira with those I have made with the same instrument in different places in England; the hygrometric condition of which has been fully and satisfactorily ascertained by the dewpoint hygrometers.

The hygrometric condition of the atmosphere requires much patient and careful investigation, and has not hitherto met with that attention which it deserves; either because the hygrometers usually employed are not to be relied upon; or, because, their construction being complex, the devotion of much time is necessary to ensure accuracy in the results of observation.

I am quite persuaded that moisture has a much greater share in developing the effects of climate upon the human constitution than most physicians imagine. This I hope to prove under the head of "Climate considered as it affects the Organization." When the humidity of various climates and localities shall be as well known, as their temperature; much greater precision will be attained in the localization of individuals, suffering from certain states

of diseased action, whether local or constitutional, than has hitherto been arrived at.

With respect to the hygrometric condition of the climate of Madeira, I must enter into some detail; particularly, as no one has confirmed Dr. Heineken's observations made in 1826, which appear to have been greatly overlooked by the medical profession, who persist in regarding that climate as essentially dry, whereas, if any confidence can be placed in the data obtained by Dr. Heineken and myself, it must be admitted to be saturated with humidity during the greater part of the year; in which respect its advantages are little superior to the climate of London; while, as regards the action of humidity on the organization, it is infinitely inferior, as I shall prove in the proper place.

Dr. Heineken's observations were made with Professor Daniel's hygrometer, and consisted of only one observation in the 24 hours,—namely, at 10 a.m.,—which may be regarded as nearly affording the mean dryness of the climate.

There is a striking coincidence in the results afforded by Dr. Heineken's observations and my own, although the instruments by means of which they were obtained, are so widely different; proving that when such observations are based on facts, instruments, however varied in their construction, must offer, upon comparison, results which accord with one another; because nature is uniform in her operations; whence the same causes invariably produce the same effects.

My observations were made every three hours; and if the mean results obtained by Dr. H. for the whole year be compared with mine, only a very trifling difference will be found; the mean of my observations made at 9 a.m. for the whole year also gives the same degree of dryness on the thermometric scales as Dr. H. observed, at 10 a.m., by means of Professor Daniel's instrument.

DR. HEINEKEN, 1826.

Mean annual dryness on the thermometric scale at 10 a.m. obtained by means of Professor Daniel's hygrometer—7°.42.

DR. MASON, 1834—5.

Mean annual dryness at 9 a.m., 3°.18—dryness observed equal to 7°.42 on the dewpoint hygrometer.*

I may remark that, should any one be induced to make further observations in Madeira with Professor Daniel's hygrometer, he must provide himself with a sufficient quantity of ether, as it cannot be procured in the island sufficiently good for the purpose, even at an exorbitant price.

I may further state, with respect to Professor Daniel's hygrometer, that the observations must be made in the shade, otherwise the results will be inaccurate, and a fallacious dryness indicated; for, although the dewpoint under both circumstances

* See Comparative Table of the equivalent values of the degrees on different hygrometers.—No. XXXII.

will be the same, the thermometer in the stem of the instrument will be proportionably higher or lower, according to the care taken to protect it from the different sources of radiation and reflection.

This caution is particularly required in Madeira, where there is almost an absolute impossibility of making observations in the shade, entirely free from the influence of radiant caloric, given out from the various buildings.

I have almost invariably found that between a thermometer placed in the shade, and another suspended in an ordinary room, out of the direct rays of the sun; there are from four to five degrees of difference.

On this account, when Professor Daniel's hygrometer is employed in Madeira, the temperature of the air ought to be taken—not from the thermometer attached to the instrument—but from another thermometer, registering the same degree, under similar circumstances, as that included within the ball of the instruments; and protected as much as possible from every source of radiant or reflected heat; in order to avoid to the utmost, the arriving at erroneous results.

In noticing these facts, it will be at once perceived that I do not wish to bring Mr. Daniel's hygrometer into disrepute. I consider the data furnished by it, when in the hands of an experienced meteorologist, of unimpeachable character. At the same time it is requisite to inform those who have not made this interesting branch of science a

particular study, that even the best instruments will give erroneous results, if every circumstance capable of leading to error be not considered, when making observations with the same instrument in different climates; for the only sure method by which one climate can be compared with another is to repeat the experiments under precisely similar circumstances.

It is much to be regretted that observers of meteorological phenomena are not more particular in describing the instruments they use; the situation in which they are placed when the observations are made; and any local circumstances likely to lead to error when the observations are compared with others, made with similar instruments. This neglect has been most prejudicial both to the science of meteorology and to the reputation of the observer—results which may be avoided by a little care. And this is very desirable; for any one, at all interested in the subject, will not mind reading, however dry they may be, a few details which may be of the greatest moment to him, and in many cases are as valuable as the observations themselves. Before concluding these remarks on the different hygrometers, and the causes of the variation of the same instrument under different circumstances; I may observe, with respect to my own instrument, that two principal causes, likely to produce erroneous results, have been urged ever since the first idea of an hygrometer by evaporation was started; namely, the influence of radiant light from the sun,

and the variable state of atmospheric currents. Both these sources of error affect the results obtained by Sir John Leslie's hygrometer in a most conspicuous manner; as I shall shortly prove by experiments made in Madeira, when comparing the indications afforded by his hygrometer with those furnished by my own.

The first of these causes, namely, the influence of radiant heat from the sun, produces little or no variation in the "degrees of dryness observed," —say, in the difference of temperature between the two bulbs in my hygrometer.

This I have proved by the most careful experiments; and can with confidence assert that the relation between two hygrometers of this construction is constantly equal in sunshine and in shade; provided radiant caloric from surrounding objects be not allowed to interfere.

I may instance two observations in elucidation of this matter—

The hygrometer in the shade stood as follows—

Temperature of dry bulb, 75°;

Temperature of wet bulb, 68°, diff. 7°;

Hygrometer in the sun—

Temperature of dry bulb, 83°;

Temperature of wet bulb, 76°, diff. 7°;

Thus the influence of the sun affects each thermometer equally; and the relative difference of temperature produced by evaporation is the same in both cases; being regulated by the elasticity of the aqueous vapours already existing in the atmo-

sphere. Mr. Daniel makes the same remarks with regard to his dewpoint hygrometer; the temperature of the dewpoint being the same whether the instrument is in sunshine or in shade.

In stating my opinion thus strongly that *my* hygrometer is not affected by radiant heat from the sun; I wish it to be distinctly understood that this occurs only when the instrument is suspended in a free space, at some distance from the ground, and apart from bodies giving off radiant caloric; for when the hygrometer is subjected to the influence of radiant caloric, given off from heated bodies, its indications are no more to be depended upon, as furnishing accurate results, than those afforded either by Sir John Leslie's, or the dewpoint hygrometer;—the indications afforded by my hygrometer being erroneous in proportion to its approximation to the source of error. However, I can with confidence assert, that the instrument may be used under circumstances in which it would be impossible to obtain correct data, either with Sir John Leslie's or the dewpoint hygrometers.

All these instruments should unquestionably be used as much as possible in the shade; and, from repeated and varied experiments, I am convinced that the hygrometer, now proposed, will be less affected by this source of error than any other, at present in the hands of the meteorologist.

The following remarks on the comparative merits of the hygrometer, by evaporation, and Sir John Leslie's—which, through the kindness of Dr.

Calvert, I had an opportunity of comparing with my own, under the same circumstances in which my observations were made—will tend to illustrate the subject.

When both instruments were in perfect shade, and free from currents of air, my hygrometer registered 1° for 6° of Sir John Leslie's—which relation, in calculating the Tables of Comparison, has been adhered to; but it is only when Leslie's hygrometer is in perfect shade, and free from currents of air, that this relation exists between the instruments; for the greatest nicety is required to make correct observations with Leslie's hygrometer, as the following experiments will sufficiently prove :—

Exp. 1.—6 a.m. Both instruments in the shade, and free from currents of air :—

Temperature of shade, 66°;
Ditto of moistened bulb, 62°.5; diff. $3°.5 \times 6 = 21°$;
Leslie's hygrometer, 27°;
Mason's ditto, 27°;—no difference indicated.

Exp. 2.—8 a.m. Windows and doors closed; instruments in the shade; the sun's rays fell upon one of the white shutters, and were reflected upon the instruments, at three feet distance :—

Temperature of air, 68°;
Ditto of moistened bulb, 62°; diff. $6° \times 6 = 36°$.
Leslie's hygrometer, 45°;
Mason's ditto, $36° = 9° +$ Leslie's ;—

giving a false indication of 9° from the reflection of the sun's rays from the white window shutter upon the instrument.

Exp. 3.—8½ a.m. More of the shutters exposed to the sun's rays :—

Temperature of air,	68°;
Ditto of moistened bulb,	62°.5; diff. 5°.5 × 6 = 33°;
Leslie's hygrometer,	46°.5;
Mason's ditto,	33°.0 = 13°.5 + Leslie's;

—showing a variation of 13°.5 from reflection.

Exp. 4.—9 a.m. Instruments as in the first experiment :—

Temperature of air,	68°;
Ditto of moistened bulb,	61°; diff. 7° × 6 = 42°;
Leslie's hygrometer,	42°;
Mason's ditto,	42°;—no difference in-

dicated.

Exp. 5.—9½ a.m. Window shutters open; the sun's direct rays not upon the instruments, but much reflected light from different parts of the room :—

Temperature of air,	72°;
Ditto of moistened bulb,	65°; diff. 7° × 6 = 42;
Leslie's hygrometer,	50°;
Mason's ditto,	42° = 8° + Leslie's;—

a variation of 8° for reflected light.

Exp. 6.—10 a.m. Instruments in the shade;

doors and windows open; strong current of air upon the hygrometers:—

Temperature of air, 71°;

Ditto of moistened bulb, 63°; diff. 8°;

Correction for current of air, .666=7°.334×6=44°.004.

Leslie's hygrometer, 58°.000;

Mason's ditto, 44°.004=13°.996 + Leslie's;
—giving a false indication of 13°.996 for current of air.

Exp. 7.—Noon. Instruments as in the first experiment:—

Temperature of air, 70°;

Ditto of moistened bulb, 62°; diff. 8°×6=48°;

Leslie's hygrometer, 48°;

Mason's ditto, 48°;—no difference indicated.

Exp. 8.—1 p.m. Window shutters open; the direct rays of the sun fell upon both instruments:—

Temperature of air, 77°;

Ditto of moistened bulb, 69°; diff. 8° × 6=48°;

Leslie's hygrometer, 103°;

Mason's ditto, 48° = 55° + Leslie's;—
being a variation of 55° produced by the direct rays of the sun falling upon the instruments.

Exp. 9.—3 p.m. Instruments as in the first experiment:—

Temperature of air, 68° ;
Ditto of moistened bulb, 61° ; diff. 7° × 6=42° ;
Leslie's hygrometer, 42° ;
Mason's ditto, 42° ;—no difference indicated.

Exp. 10.—4 p.m. Leslie's hygrometer in the shade, 40° ; window shutters open, so that the direct rays of the sun fell upon the instrument. It fell to 106° in ten minutes, being a variation of 66° under the same state of dryness.

From these experiments it will be perceived that Sir John Leslie's hygrometer varied from 8° to 35°; whereas the hygrometer by evaporation, under the same circumstances, varied only .666 of a degree. A second hygrometer by evaporation was kept in the shade during the time, to compare with the others. I regret not having been able to procure two of Leslie's hygrometers, as the comparison may be thought not so accurate; but in all those variations, when the causes of disturbance were removed, the other hygrometer always indicated the same relative difference with my own.

The second cause of error to be guarded against is not of that importance which has hitherto been represented as placing an effectual barrier to the construction of hygrometers on the principle of evaporation ; since I have proved, in the article above referred to, in the "Records of General Science," vol. IV., page 23, on the theory of my hygrometer,

that "the depression of temperature, produced by currents of air, has, under given circumstances, a certain and constant limit, beyond which it will not pass;" and that, so far as I have observed, the difference produced by this cause varies with every degree of humidity, and is always constant at that degree, whatever be the temperature. Consequently, a rapid circulation of the evaporating medium will quicken the depression of temperature in regard to the time of its attaining the utmost limits of *refrigeration*; but, so long as the atmosphere possesses the same degree of dryness, or humidity, this cause cannot affect the amount of depression produced. With regard to the climate of Madeira, supposing the hygrometer to be exposed to a strong wind, even at the maximum dryness which I ever witnessed, independent of *Leste*, it would only indicate an excess of dryness by the instrument of 1°.5; in a moderate breeze, .75; a gentle breeze, .375; and the agitation likely to occur in an apartment without a fire, under ordinary circumstances, would not exceed .187 of a degree. By referring to Table XXII., it will be perceived that the mean dryness of the year, indicated by my hygrometer from 9 a.m. to 9 p.m., is 3°.91. Now, by the data above referred to, the indications afforded by the instrument, supposing the necessary corrections to have been made for this cause of variation, would only alter the degree of dryness observed, or difference of temperature between the two bulbs, .651, supposing also the hygrometer to

have been under the continual influence of this cause of variation at the mean dryness of the climate.

In the situation where the instrument was placed, I am confident that this cause would not alter the mean results above .031 of a degree. I may also state that if you take a mean of the variations produced by the different force in the velocity of the currents of air, supposing the hygrometer constantly subjected to that influence; it would only give an increase of .394 to the mean maximum, .292 to the mean dryness of the year; and *that*, in favour of the dryness of the climate.

As only the differences between the two bulbs have been registered in the Tables of Humidity, the absolute dryness is not shown; which, of consequence, must be determined by calculation, or may be seen in the Comparative Table, showing the equivalent indications afforded by the dewpoint hygrometer, Sir John Leslie's, and my own. It would, perhaps, make the matter more intelligible to those, who have not had leisure, or opportunity, to pay attention to the results afforded by different hygrometers, to state that the Tables, referred to, do not show the actual quantity of moisture existing in the atmosphere; but its distance from the point of saturation in degrees of Fahrenheit's thermometer.

The quantity of moisture the mean temperature of any climate would support, if saturated, will be easily discovered by consulting Professor Daniel's Tables on the subject.

For those who have not had an opportunity of consulting Mr. Daniel's valuable work on Meteorology, the following remarks by Sir John Leslie will tend to illustrate the question. He observes, "the law being known of the dissolving power of the air as affected by heat; it is easy, from the disposition of the air with respect to humidity at one temperature, to derive that of any other. Supposing the air at the freezing point to be capable of holding 50 parts of moisture, at 50° Fahrenheit it will hold 100 parts; at 68°,—200 parts; at 86°,—400 parts: thus, doubling its humidity at each increase of 18 degrees of Fahrenheit's scale." Thus, as regards the climate of London and Madeira, or rather the lower part of the valley on the south of the island on which Funchal is situated, we may state, according to the above observations of Leslie, that, at the temperature of 50°, which is near the mean temperature of London, the air, if saturated, is capable of holding 100 parts of moisture in solution. But at the temperature of 68°, which is rather more than the mean temperature of Funchal, it will contain 200 parts, or nearly double what it is able to support in London. But let the hygrometer at either place indicate the same degree, —suppose 4°: it is then unquestionably proved that, at both places, the air is within 4° its full saturation,—the actual quantity existing, being dependent upon the temperature of the place.

The following Tables show the amount of vapour, in grains, which the mean temperature would sup-

port per cubic foot if saturated, for the climate of London, and Funchal in Madeira—deduced from Mr. Daniel's Tables :—

London.	Mean Temperature.	Weight per cubic foot in grains.
Winter..................	39.12	3.163
Spring	48.76	4.376
Summer	62.32	6.613
Autumn	51.37	4.738
Year	50.39	4.593

Funchal, Madeira.	Mean Temperature.	Weight per cubic foot in grains.
Winter..................	59.50	6.134
Spring	62.20	6.619
Summer	69.33	8.187
Autumn	67.23	7.709
Year.....................	64.56	7.134

CHAPTER II.

COMPARATIVE HYGROMETRICITY OF MADEIRA.

To those who may still doubt the possibility of ascertaining the dryness of the atmosphere, or its distance from the point of saturation, by means of evaporation, I may be allowed to offer a few further remarks; as, although they should question whether such means be scientifically correct, they cannot doubt that a comparison between the same instrument, under different circumstances, affords accurate indications; when the facts are clearly established by Mr. Daniel's instrument.

This we have the means of doing in Madeira by a comparison between the *Leste*, or hot dry wind, which occasionally visits this Island from the coast of Africa; and the atmosphere in its ordinary state.

The African wind, called by the Italians *Sirocco*, has quite opposite qualities to that which the Portuguese call *Leste*, and the English frequently *Siroc*.

This difference, if not clearly defined, may lead to serious errors, both scientifically, and as regards its influence on the animal economy.

The wind called by the Italians *Sirocco*, which visits Naples and the south of Italy from the opposite shores of the Mediterranean, is hot, *moist*, and relaxing. On the contrary, the wind denominated by the Portuguese *Leste*, is essentially *hot* and *dry*, and of a highly stimulating nature; so that it soon exhausts those in health by means of its exciting qualities.

It is similar to the *Samiel* or *Simoon*, is described as a burning pestilential blast, extremely arid, which frequently springs up in the vast deserts of Arabia, and rushes forth with tremendous fury, involving whole pillars of sand. As a proof that it is the same wind, I may observe that on the 6th and 7th of November, 1834, I observed the furniture covered with an impalpable reddish powder. On the 6th, the atmosphere presented a very peculiar appearance; the wind was E.S.E., the valley was universally covered by mist so that neither sea nor mountains could be seen; the former being distant half a mile, the latter a mile-and-a-half from my residence. The sun appeared as though viewed through a smoked glass, but very pale; this phenomenon continued throughout the day. The night was dark, no stars being visible; and without the least terrestrial radiation. The maximum power of the sun during the day was only 83°, whereas the

day previous it was 130°; on the 7th it was 100°, and on the 8th it amounted to 136°. The inhabitants remarked that it was a very unusual occurrence. The 7th was very cloudy, and some light rain fell; the night was bright and cloudless, but no deposit of dew was observed. The same phenomena occurred at sea during the same days, and was observed by passengers on board the "New Phœnix," when 180 miles distant from Madeira. The rigging and decks of that vessel were covered by an impalpable red sand; so abundant as to render it necessary to clear the vessels from the annoyance; and the shipping in Funchal harbour were also covered with it. The wind was East by compass. The sand must have passed over 200 miles of sea, and I much regret not being able to procure a specimen; but either from apathy, or want of laudable curiosity to investigate so strange an occurrence, not one of the passengers procured a specimen. Such palpable neglect of the phenomena of nature but too clearly proves how very few are capable of appreciating even rare occurrences—much less the fleeting and daily changes of atmospheric phenomena, to which they have been inured from infancy.

I will now proceed to prove the hot, dry nature of the *Leste* or Simoon wind.

Dr. Heineken, in his paper on the Climate of Madeira, published in 1826, observes, with regard to this wind:—" I take for granted that it is very well established, although I am ignorant of the

explanation, why the *Sirocco* here is so *perfectly dry*, and that of the Mediterranean so loaded with moisture. It reaches us immediately from the coast of Africa, after passing over about 300 miles of sea:—not a cloud is to be seen during its continuance; the whole atmosphere is of one uniform unvaried blue—very light blue-grey—of a peculiar character, as though viewed through, what a painter would term a very thin warm aerial haze; it blows from E.S.E.; lasts almost invariably three days, and encounters you like puffs from the mouth of an oven or furnace; the eyes and lips feel much as they do when exposed to a keen easterly wind on a frosty day, in a northern climate; birds and insects seem to suffer from it more or less, and fowls confined in a close yard generally droop. Furniture warps and cracks; books gape, as they do when exposed to a fire; and it is generally inconvenient and oppressive. Some have *asserted* that it has raised the thermometer as high as 130° in the sun, and 95° in the shade; but I *doubt* the accuracy of the observations: for in the course of four years I have never seen it raised above 85° in *perfect shade*. There is, however, nothing in which observers are so likely to differ as in their results of the *maximum heat in the shade* in this place. I do not believe that it is to be *accurately* obtained but by a series of observations, made upon several instruments, in various situations; for the sun is so vertical that no one thermometer, permanently fixed in one given

place, can remain during the twenty-four hours uninfluenced by either its direct or reflected rays. Throughout the year of 1826, the *Sirocco* visited us seldom, and then was generally either incomplete in its character or partial in its influence: but, in a former year, the hygrometer, during its prevalence, once showed 45° of dryness, and even then ether failed to produce a deposition." These observations accord with what I have myself observed, excepting those which regard solar radiation; and I may be allowed to say that, however Dr. H. may question the accuracy of other people's observations, it is clear he has not contradicted them on the sure ground of direct experiment; for, in that case, he must have seen in the course of four years' observation, that a thermometer, exposed to the rays of the sun in the manner stated by Mr. Daniel, in his work on the subject—which work Dr. H. had in his possession—would indicate a temperature of 130° or upwards. By referring to Table XXVI., it will be seen that, on the 22nd of October, the power of solar radiation amounted to 138°. On that day occurred the strongest *Leste* I have observed during my residence on the Island. With respect to the dryness indicated by Mr. Daniel's hygrometer, I must refer to the above observations by Dr. H. If we take 85° for the temperature of the air in perfect shade, and subtract 45° of dryness on the thermometric scale; we shall have the dew-point at 40°, which, calculated according to Mr.

Daniel's formula, will give the following results, viz. :—

Temperature of the air in the shade..	85°;
Dewpoint	40°;
Degree of dryness on the thermometric scale	45°;
Degree of moisture on the hygrometric scale	.226;
Elasticity of vapour	.280;
Weight of vapour in grains, in a cubic foot existing in the atmosphere	2.965 grains;
Weight of vapour, the temperature in the shade would support if saturated	13.081 ,,
Difference, or quantity of vapour required to produce saturation	10.116 ,,

I may observe that the air was still more dry than is here indicated, as there was not any deposit observed during the experiment.

Now, if we compare the condition of the atmosphere with the mean of the year deduced from the same gentleman's experiments—which may be considered as near the mean of the climate—we shall see, at the same time, the very humid state of the climate generally, and the great dryness which is experienced during the *Leste*.

ORDINARY CONDITION OF THE ATMOSPHERE.

Mean temperature of the air in the shade	68°.12;
Do. dewpoint	60°.70;
Do. degree of dryness on the thermometric scale	7°.42;
Do. degree of moisture on the hygrometric scale	.791;
Do. elasticity of vapour	.572;
Do. weight of vapour in grains, per cubic foot, existing in the atmosphere	6.360 grains;
Do. weight of vapour in grains which the mean temperature would support if saturated	7.980 ,,
Do. difference or quantity of vapour required to produce saturation..................................	1.620 ,,

On comparing the observations made with the hygrometer by evaporation during those distinct conditions of the atmosphere, we shall find the same results indicated. By referring to the Tables, it will be seen that the maximum dryness observed during a *Leste* is 22°.5, and that the mean of the year, from 9 a.m. to 9 p.m., only amounts to 3°.91; while if the humidity during the night were taken into account in calculating the mean dryness, it would be at least 1½ degrees less; making the

mean annual dryness of the climate only $2^{\circ}.5$, or at most 3°.

The condition of the atmosphere, during a *Leste*, is by no means too dry for a great proportion of invalids sent to this Island; indeed, it is only during its prevalence that they feel the cheerful influence of climate, and express themselves, strongly, that, could they live in a perpetual mild *Leste*, or in other words a warm and equally dry atmosphere, they would soon recover. It almost amounts to a proverb amongst the residents of the Island, that those with whom the *Leste* agrees seldom recover; and accordingly such cases are set down as the most unfavourable. Now to a reflecting mind it must be obvious that all those individuals with whom the *Leste* agrees ought not to have been sent to Madeira; as, under the most advantageous circumstances, they will only enjoy perhaps a dozen days, calculated to give them a chance of ameliorating their condition; for, the general conditions of the atmosphere being directly the reverse of what they require, they, of necessity, rapidly get worse, or do not make the slightest improvement. This is not owing to the malignity of the case itself, but to the individual being placed under conditions the most unlikely to promise any benefit from the effects of climate. From my own observation I should say that, as soon as any invalid finds that he becomes better during a *Leste*, it would be advisable for him to seek a drier climate without delay. On the other hand, invalids, who feel oppressed and languid dur-

ing its influence, are those who are likely to derive benefit from a residence at Madeira, and may naturally hope to be reinstated in health as far as their organic condition will allow of being brought into a favourable state.

On the other hand, we may naturally infer that those invalids, who have visited the coast of the Mediterranean for the sake of health, and who find the *Sirocco* agreeable to them; had better quit its shores and proceed to Madeira, where they will find a mild and permanent condition of atmosphere, similar to the *Sirocco* which visits Naples and the south of Italy, being essentially warm and moist. I may also add that the dryness experienced, during the strongest *Leste* I have observed at Madeira, has been equalled on the continent; for Sir John Leslie mentions, that on one occasion his hygrometer, at Paris, in the month of September, was at 120°, so that a thermometer with a moistened bulb, according to his calculation, would have remained, under the same circumstances, 21°.6 below the temperature of the air.

The next comparison I shall offer is between my observations at the different ports in the British Channel, during my voyage to Madeira in 1834; and those made during my residence in the Island. All the observations were made with the same instruments, so that an accurate comparative view may be depended upon. No one will doubt the humidity of our own coasts in the months of January and February, especially during the S.W. gales;

as it is well established by Mr. Daniel that the dew-point of the sea winds, viz., the S.W.W. and N.W., is three degrees higher than that of the land winds, viz., the N.E., E., and S.E.

Mean of twelve observations made in the open air, at Portsmouth, in January, 1834:—2° noon minimum, or complete saturation. January 23rd, temperature of air, 55°; moist bulb, 55. The maximum dryness was 3°.5, at 9 a.m., viz., temperature of air, 36°.5; temperature of moist bulb, 33°; clear cloudless sky. The weather was generally raining during the time these observations were made.

January 31st, Portland Roads.—Made three observations during the day. Wind S.W. by S.; mean temperature of air, 50°; mean of moist bulb, 44°.4; mean dryness, 5°.6.

February 6th, Cross Channel, Falmouth. Variable weather; wind, S.W., S.S.W., and N.W. Mean of four observations:—mean temperature of air, 52°.5; mean of moist bulb, 49°.0; mean dryness, 3°.5.

The mean of nineteen observations gives a dryness of 3°.7. The maximum dryness I observed was at noon, on the 6th of February, Cross Channel, near Falmouth, on board the "New Phœnix," viz., temperature of air, 52°.5; temperature of moist bulb, 46°; 6°5. of dryness.

This comparison, proving the humidity of the climate of Madeira, will be better seen by the following Table:—

Mean of nineteen observations, made at different ports in the Channel, in the months of January and February	3°.7;
Maximum dryness observed on the 6th of February	6°.5;
Mean annual dryness of Madeira, 1834-5	3°.91;
Mean dryness of January, 1835, between the hours of 9 a.m. and 9 p.m.	3°.10;
Do. of February, 1835, do., do....	4°.26;
Mean of January and February	3°.68;
Maximum dryness observed during January.	6°.00;
Do. do. February...	7°.00.

Since my arrival in England, the few observations I have had an opportunity of making, tend to prove that London and its vicinity are drier than Madeira, at the period of the year they were taken. The mean of twenty-four observations, made between the hours of 9 a.m., and 9 p.m., on the 23rd, 24th, and 25th of June, 1835, at East Wickham Hall, near Welling, Kent, gives a dryness of 3°.83. The maximum was 7°, the minimum 1°. These observations were made in the library, the windows being open. The weather was very cold and rainy, during the above period.

The mean of forty-four observations, made between the hours of 9 a.m. and 9 p.m., on the 9th and six following days of July, at Princes-street, Finsbury-square,—the weather being warm and fine—gives a dryness of 6°.20. The maximum being 9°, the minimum 1°. If we take the mean

between the dry and rainy days, above named, it will give a mean of 5°.01; while the mean of June and July,—the two driest months in the year in Madeira, with the exception of August—only give a dryness of 4°.73. We also see that the mean of forty-four observations in July, when the weather was fine, gave a mean of 6°.20, while the mean of the same month in Madeira, is only 4°.95, being a difference of 1°.25 in favour of London. The maximum dryness is the same in both; while the minimum is 2° lower or further removed from the point of saturation in London than in Madeira.

In the last place; in order to prove the dampness of the climate, I may instance the impossibility of keeping iron, in any form, from being rapidly oxydised. The different powders, such as opium, squills, &c., soon lose their pulverulent form, and become firmly united into a solid mass; various neutral salts rapidly deliquesce; gloves, shoes, &c., soon become covered with various species of cryptogamous plants; silks become spotted, and unfit for use; piano-fortes frequently require retuning; and the screws of various other instruments, as violins, guitars, &c., become so tight as to be almost immoveable. In fact it would be impossible for vegetation to flourish, were not the atmosphere almost saturated with moisture; as frequently, during the fine season, there is scarcely a shower of rain for three, four, and sometimes even six months in succession.

CHAPTER III.

OF THE SEASONS OF 1834 AND 1835 IN MADEIRA.

Sufficient has been said respecting the instruments employed in making the observations, the results of which are contained in the Tables; but, before proceeding further, a few general remarks, respecting the year 1834, will not be misplaced. The weather was considered, by the inhabitants, as being very extraordinary. They remarked that the summer was the *driest* that had been experienced by the oldest inhabitant, and the winter the *most rainy* and unseasonable; yet no one could satisfactorily account for the variation—one referring it to the inequality of temperature; another to the quantity of rain that fell; a third to some peculiarity in the atmosphere. Mr. Howard's opinion on this subject I should consider, on the whole, the most unexceptionable: viz.,—"that our recollection of the weather, even at the distance of a few years, being very imperfect, we are apt to

suppose that the seasons are not what they formerly were; while, in fact, they are only going through a series of changes, such as we have heretofore already witnessed but forgotten." In support of this remark, I may refer the reader to Dr. Gourlay's observations on this Island, who, out of fourteen years' observation, enumerates no fewer than nine *remarkable* winters.

Dr. Heineken, in 1826, observes, "that 43.35 inches of rain fell; *but so much rain had not before been remembered by the oldest inhabitant.*" In 1825, only 20.43 inches fell; whence he regards 30 inches as being near the truth of the mean of a series of years. Since that period, only eight years have elapsed, and, still, the remembrance of the oldest inhabitant is, again, brought into the field. By these remarks I by no means wish to deny the veracity of the residents; but, only, to make some little allowance for the remembrance of such data as the merits of the case generally warrant. Some allowance ought, certainly, to be made for such unqualified assertions; particularly as, even at the present time, it would be a difficult task to convince many of the residents that the climate is at all damp; although the fact admits of being proved in the most satisfactory and philosophical manner. In illustration of their want of even common observation, I may give one instance, which I would strongly recommend to the consideration of every invalid who resorts thither for the benefit of his health, that he may not be led into error by re-

lying upon the mildness of the temperature during the evening, or the prevalent custom, among all classes, of keeping their windows open late, at that period of the day.

During a *Leste*, the residents close every door and window, to prevent the entrance of dry air; but they have not had sufficient acumen to discover that, in the ordinary condition of the atmosphere, by closing their doors and windows before the more damp air enters, towards evening, they would, in a great measure, free themselves, both from the annoyance which such a practice produces, and from the danger, likely to arise from exposing themselves to constant currents of cool humid air. On the contrary, guided by their own feelings, they open every window, and complain of being oppressed by the heat, and perspire freely; whereas the truth is, that the air is from 2° to 5° colder, but from 3° to 6° nearer the point of saturation, than it was during the maximum dryness and temperature of the day. Now, as during the day, when the temperature is at its maximum, they never complain of this oppression; it is clear that what they feel is not produced by heat, but is referrable to that more humid condition of the atmosphere, which considerably retards pulmonary exhalation, so as to require an increased discharge from the skin. This discharge, meeting with great tension in the vapour, already existing, does not assume the state of insensible perspiration so rapidly as in the middle of the day, but is condensed in the

form of sweat. In my own house, where the windows and doors were regularly closed at a proper period, this oppression was never complained of; nor were the ladies obliged to fan themselves without intermission.

The very frequent and remarkable variations in a given series of years — providing the ordinary observation of the inhabitants be strictly correct—incontestably prove that Madeira is no more to be relied upon, than any other place, for certainty of fine weather, and that it has, equally, its annual variations of temperature.

That the extraordinary character of the year 1834 did not depend upon inequality of temperature, the tables will sufficiently prove; and I believe that it did not result from the actual quantity of rain which fell in Funchal; for I was informed by a gentleman, well known for his scientific acumen and perseverance, and who, moreover, kept an account of the fall of rain along with Dr. Heineken, in 1826, that *considerably more rain fell that year in Funchal, than during the period of time to which the present work more immediately refers.* Moreover, the peculiarity of that year must have been attributable to a greater prevalence of continuous wet; the rain not falling in those violent and intermitting showers, which are so characteristic of this climate; but, rather, after the manner of our own autumnal season.

The number of days on which any rain falls here, is set down by all previous writers on Madeira at

73. During the last year, however, there were 101, giving a majority of 28 days more than the mean of a series of years.

That a larger quantity of rain, than ordinary, fell upon the heights above Funchal cannot be doubted, as the rivers had not been so much swollen since the great flood in 1803; and some of the residents go even so far as to say that the rivers were much fuller, this year, than at the time when there occurred so dreadful a sacrifice, both of life and property.

Lastly—taking it for granted that the summer was the most dry, and the winter the most rainy, that had been experienced for a great length of time—my observations will not be of less utility to the public, than if made during what the inhabitants would call *a regular Madeira year;* as they will show the greatest extremes to which the climate is liable, and the mean will not be altered, as each excess will be obviated. Besides, the comparison between the extreme *dryness* of the summer and the excessive *humidity* of the rainy months, namely, October, November, December, and January will prove, in the most unexceptionable manner, the decided humidity of the climate; the mean of the former being 5°.10, and the mean of the latter, 2°.81; which only gives a difference of 2°.19 between the extreme of dryness and humidity, ever likely to occur.

The latter part of the year 1834 and the commencement of 1835 were mild, as not any snow lay on the mountains above the city, and no ice

could be procured for the ice-house. Very little snow was also noticed on the mountains in the north of the Island.

The observations, made at Sta. Luzia, apply to that locality alone, and cannot, in any way, be made to suit the Island, generally; nor will they give precise information relative to the lower part of Funchal, near the sea, especially as regards the progress of humidity during the day—although, in point of temperature, they may be very near the truth; the slight radiation to which the thermometers were subjected, compensating for the more elevated situation in which the observations were made. I may also remark that almost every locality offers something peculiar, alike with regard to temperature, humidity, or the local winds which prevail; and that, until a series of observations shall have been made in different localities, the full merits of the climate, as regards its suitability to different diseases, or even stages, of the same disease, will never be fully ascertained. Indeed, I very much question whether the valley of Funchal is the best calculated for invalids, generally; and, could suitable accommodation be procured in other parts of the Island, I am confident that many would derive advantage from the climate, although their hopes might be altogether blighted by a residence in Funchal, or even at a convenient distance in the country, immediately above the town.

Invalids, for the most part, generally reside immediately above the town, in the same line in

which my observations were made, or from one hundred to one hundred and fifty feet higher—this situation being preferred, in consequence of the noisome stench, the unceasing chime of bells, and the unpleasant vociferation of the natives who are employed in driving the oxen, together with the filthy and forlorn objects which continually meet the eye in the interior of the city.

CHAPTER IV.

WINDS IN MADEIRA.

Preparatorily to my offering any remarks on the tables, and in order to elucidate more clearly the equality of the temperature, it will be necessary to say a few words on the land and sea breezes, which are the N.E. and S.W.; I must premise, however, that my observations on this subject refer only to the district in which they were made, and to the precise time of their occurrence.

It is upon the regularity of those winds that the salubrity of the place depends; for, whenever there is any remarkable or continued variation of such currents, the health of the inhabitants suffers more or less severely; principally, as I imagine, from the surrounding medium being charged with the effluvia of animal as well as vegetable substance, in a state of putrefaction; which, on account of the uniformly high temperature and the humidity of the climate, takes place with great rapidity. No measures being employed to prevent or remove the accumulation

of refuse, arising from the assemblage of twenty-five thousand people, the local atmosphere is soon surcharged with impurity, in the absence of the land and sea breezes—the latter of which considerably dilutes the poison, while the former conveys it over the immense bed of the ocean, rendering it comparatively harmless in its effects on the human organization. The numerous tanks, kept to irrigate the gardens, during the summer, and the water in which is seldom renewed more than once a month—in some cases, only once in two or three months—give rise to noxious effluvia. The surface of this water is sometimes covered with green animalculæ of various species, producing abundance of mosquitoes.

I feel fully justified in attributing to these sources the effect of poisoning the air; as I suffered severely in my own person all the symptoms, generally referred to the effects of marsh effluvia,— such as extreme lassitude, pains in the head and limbs, intolerance of light, mental depression and anxiety, dry, parched, brown tongue, &c.—all which disappeared in three days, without the aid of medicine, upon removing to Sta. Cruz, a few miles from Funchal. On my return to Sta. Luzia, the same symptoms re-appeared after a residence of a few days, and continued, unabated, till this source of annoyance was partly removed; when some amelioration of the symptoms took place. I have not the least doubt that they would have disappeared completely, could the stagnant water have been

entirely got rid of; but, although my landlord had lived some years in England, I had much trouble to convince him that water could be at all offensive, after being kept two months in a tank. As a proof of the contrary, he asserted that the tank had been kept full for two years, without changing, and that, at the expiration of that period, the water was perfectly sweet! I instance this as a specimen of the ignorance an invalid may have to contend with, and the impossibility of freeing himself from many causes of disease; although the removal of them might be so easily effected, could the natives be made sensible of the dangers, to which, by their apathy and ignorance, they expose themselves and others.

The land and sea breezes, together with the cloudy atmosphere which hangs over the valley and mountains on the south side of the Island, are referrable to the causes detailed in the memoirs of Sir H. Davy, namely, "the unequal degree in the radiating and absorbing power of the land and sea." Madeira, from the minuteness of its size, compared with the ocean by which it is surrounded, the height of its mountains, the volcanic nature of its soil, and the great quantity of basaltic rock, uncovered by vegetation and continually exposed to an almost vertical sun; presents a beautiful miniature representation of this phenomenon. After the setting of the sun, the surface of the sea, and consequently that portion of atmosphere which reposes on it during the night, become warmer than the earth and

the immediately superincumbent air; both of which, from the nature of the climate, and its situation in the midst of an immense ocean, are almost saturated with humidity. The earth, on the contrary, from its greater radiating power, becomes cooler; and the air above it, following all its changes, becomes of a lower temperature than that over the ocean. Consequently, the former descends, and mixes with the mist, as it forms on the surface of the water, whose comparative warmth keeps up the ascent of the vapours, which continue to rise till after the appearance of the sun; at which time the land breeze gradually terminates, and gives place to the sea breeze. The latter arises from the fact, that the local atmosphere, over the land, becomes more heated by the rays of the sun than that over the sea; because the sea, from its depth and nature, absorbs more of the sun's rays, rendering the air above colder, whence, consequently, it rushes over the land, carrying along with it the vapour with which it is charged. The atmosphere over the land continues more rarified till after the setting of the sun, when the phenomenon of the land breeze takes place.

The land and sea breezes alternate with great regularity during the summer months, but during the rainy seasons they are irregular. Indeed, if from any cause they pass over the regular time of their appearance, more or less rain generally follows, accompanied with strong winds. At Sta. Luzia, during the period of time in which my ob-

servations were made, these winds occurred in the following order :—In March the land wind, N.E., set in from 6 p.m. to 9 p.m., continued all night, and gave place to the sea breeze, S.W., which reached us from 8 to 9 a.m., and continued till after sunset. April; sea breeze half-past 8 a.m., frequently N.W, at 6 p.m. In the middle of the month the winds were irregular, but towards the termination they became regular again. May and June, regular; sea breeze at 9 a.m.; land breeze at 9 p.m. In July and August they were very regular, occurring half an hour earlier morning and evening. September, irregular. October, regular; but the N.E., or land wind, occurred earlier in the evening. If it continued later than 9 a.m., more or less rain invariably followed, during the day. November and December, irregular, during the day, but regular, during the night. January, early part, regular; towards the close, irregular. February, irregular.

I have not attempted to give any account of the general winds—that being almost impossible; for all indications on shore, or in the bay, serve only to deceive. With regard to the direction of the clouds, a like uncertainty is experienced; for I have frequently seen three different currents, while the vane indicated a fourth. The highest clouds generally advance from N. to S., while the next strata take various directions according to the time of the year, &c. The lowest strata follow the land and sea breezes with great regularity. During the

heavy rains, the clouds came from the S.W., or from some point, either W. of S., or W. of N. When the weather is settled, the clouds generally come from the opposite points, viz., from the Eastward of North and South. With regard to the hygrometric state of the land and sea breezes, their properties vary with the time of observation. In the day, the humidity begins to increase immediately after the temperature has attained its maximum, and is on the decline, about 4 p.m , during the autumn and winter; while, in spring and summer, the mean dryness does not attain its mean maximum till 6 p.m., when it rapidly declines.

This is not so distinctly seen in the tables, as the doors and windows were always closed before sunset; but an hygrometer, exposed in the open air, readily detected those rapid changes; the effects of which were partly obviated by preventing the entrance of the night air, constantly charged with humidity. By referring to the tables which show the daily range of humidity, on the lineal scale—first designed by Howard to mark more clearly the range of temperature—the gradual rise and fall of the vapours, from morning to night, will be perceived. As soon as the land winds set in, the hygrometer begins to indicate an accession of humidity, which goes on increasing till after all the clouds have passed over the valley, from the mountains to the sea. This generally occurs about 11 p.m., when the hygrometer either rises or remains stationary; so that, at 6 a.m., a greater degree of

dryness is indicated, because the land wind, which descends from the higher parts of the Island, has become dryer during the night, and the dense clouds have passed over the ocean; a great mass of vapour, also, being precipitated in the form of dew. At 9 a.m., when the sea breezes reach Sta. Luzia, the hygrometer generally indicated two degrees nearer the point of saturation. This approximation, then, gradually increased in proportion to the rise of temperature, until it had attained its maximum, at the time before mentioned. During my residence in Funchal, near the sea, in the months of March, April, and part of May, I found that, at 6 a.m., much less dryness was indicated, than at the same hour at Sta. Luzia—showing that the sea breeze sets in soon after sunrise, and that it gradually ascends to the higher parts of the valley. In the afternoon, about 4 p.m., a greater state of humidity was indicated than at Sta. Luzia. In town the humidity progressively increased from that time to a later hour, than in the former situation; so that from 5 p.m., to 8 p.m., was the most oppressive period of the day, and the most unsuited for an invalid to expose himself, either in the open air, or at the open windows—a custom very prevalent, as I have already stated, amongst every class here. Those breezes tend to maintain an equality in the temperature, by lowering it, during the day; while, in the night, it is not much reduced by radiation, as that is greatly prevented by the cloudy state of the atmosphere.

CHAPTER V.

CLOUDS AND SKY.

The next subject which demands attention is the invariably clouded state of the sky, in a great measure dependent upon the height of the mountains, both for the origin of the clouds, and for their course. The clouds modify, greatly, the influence of direct solar radiation, and are the cause of much secondary light and heat; which being always proportioned to the cloudy state of the atmosphere, very little effect is produced upon the most delicate instruments under a dark blue, cloudless sky; whereas the force of the sun's direct rays, under those circumstances, is at its maximum effect.

The vapour follows the direction of the land and sea breezes, besides being modified by local currents of air, produced by the numerous ravines and high lands which intersect the valley from north to south.

I have not been able to refer the forms of the clouds to Mr. Howard's classification, notwithstand-

ing many endeavours to trace a resemblance. Not being qualified to offer anything original on the subject, I may be pardoned for giving his description of the most common forms which, at all, resemble those of the clouds that present themselves over the south side of the Island; and although the correspondence may be very incomplete, yet, with a few comments, I may convey some notion of the general appearance of the atmosphere, when the vault is clear and free from detached clouds—a rare occurrence, even for two or three hours together. The best idea I can give upon the subject is that of a very light clear blue, viewed through a transparent gauze of a yellowish-white—the colour being produced by the combination of the two. Such is the aspect, when, the stratum of vapour, being detached, and forming into separate clouds, the sky is seen through a light and almost invisible medium.

The next appearance of the sky is of a clear light blue colour. This occurs when the clouds become detached in large patches, but generally in much less proportion, than the space, occupied either by large, white, detached, well-defined clouds, or large sheets of cloud of a yellowish-white appearance, filling a considerable portion of the vault, especially towards the horizon. Frequently, the detached clouds are of a dark Indian-ink tint; especially on the sides and tops of the mountains which form the northern boundary, and rise to an elevation of about 3,000 feet above the level of the sea. Without detached clouds, I never saw

the sky of a light blue appearance. It is always of the colour above described; or of a vivid white, with a slight tint of blue.

During a *Leste*, the sky presents a peculiar appearance; and, although perfectly cloudless to the eye, and of a transparent light and greyish-blue colour, yet no doubt can be entertained that this seeming free expanse is formed of one continued sheet of cloud, at a great elevation; as the direct rays of the sun do not produce so great an effect upon a thermometer as during the ordinary state of the sky, when large patches of clear light blue are to be seen. This will be found to be conclusively proved, upon a reference to the tables.

I may also state that rain generally falls within twenty-four hours after the *Leste* has altogether ceased; and that I have seen a very strong precipitation of dew, three hours afterwards, the atmosphere being reduced from 17° to 7° of dryness on my hygrometer; and, at seven, the following morning, to 2°; while the plants and shrubs were covered with dew.

Nothing can demonstrate, more clearly, the law which regulates the diffusive power of vapours; namely, that the lower their specific gravity, or the lower the temperature at which condensation would take place, the greater their diffusive power, and, consequently, the more rapid the evaporation. Thus we find, a few hours after the *Leste* has ceased, the whole atmosphere, from being intensely dry, becomes surcharged with humidity.

From the rapid evaporation, the temperature of the air immediately over the ocean becomes proportionally reduced: the caloric being rendered latent, during the conversion of water into an elastic form of a comparatively high tension.

By the law, previously stated, as regulating the sea breezes, this cold air, almost saturated with humidity, rushes over the land. It there meets with air at a much higher temperature, and capable of supporting a still greater weight of vapour; and, although the air over the land is not so near the point of full saturation, as that, over the ocean, it acquires absolutely a larger quantity of vapour in point of weight; and, on its ascent, in coming in contact with air at a lower temperature, we see clouds rapidly formed. This arises from the fact, that the tension of the mingled vapour always exceeds the tension belonging to the mean temperature; a result which arises from the mixture of the air at different temperatures, producing an excess which must be precipitated either in the form of heavy dew or rain.

This accounts most satisfactorily for the fact, that, after the cessation of one of those hot, parching winds, the atmosphere invariably becomes more cloudy and dense, than ordinary.

HOWARD'S DESCRIPTION OF CLOUDS.

"The *cumulus* is an aggregate which seems to retain an electric charge, just sufficient for its own buoyancy during its increase. The several clouds

of this kind must likewise exercise a degree of repulsive action on each other; since, when the modification is pure, they keep, as it were, at measured distances in the sky."

Few detached clouds of this description are to be seen in Madeira. Does this infer a want of electricity in the atmosphere?

"The *cirrus* may be regarded as a collector of electricity, as well as of the scattered particles of water, from the higher atmosphere."

The *cirrus* is very unfrequent in Madeira, seldom occurring except before and after a *Leste.* Does this imply a want of electricity, and of low strata of clouds? The pure *stratus* is not common, the clouds seldom remaining stationary.

"The *cirro-cumulus*, in point of elevation and buoyancy, is next to the *cirrus.* This cloud may be considered as a system of small cumuli, maintaining a sort of equilibrium among themselves in their electric charge, or tending slowly to inosculate laterally. It is the natural index of a rising temperature in the higher atmosphere; and the warmth of the region in which it floats is commonly felt, after some time, at the earth's surface."

This form of cloud I should think the most common in Madeira, especially during the spring and summer months.

"The *cirro-stratus* is the natural index of depression of temperature in a vaporous atmosphere; and consequently of wind and rain. It may be conceived to originate in the condensation of vapour

in successive horizontal strata, the product immediately subsiding through the air below, where it still receives an increase. It is apparently non-electric, or but very weakly charged, and wets all bodies alike, whether from a peculiarity of internal constitution, or from its general thinness: this cloud furnishes, almost exclusively, the skreens in which are represented the circles of the *halo*, with their occasional accompaniments, the parhelion and para-selēne."

This form of cloud is common toward evening, about the higher part of the valley, next the mountains.

"The *cumulo-stratus* may be regarded as the intermediate state between the *cumulus* and rain; or, rather, as that in which the clouds may remain for many hours together, prepared either to afford showers or to disperse, according to the course of temperature, electricity, and other attendant circumstances. It is by far the most common cloud in changeable and even in fine weather. Banks and ranges of cloud of every description, presenting a flattish surface, and bounded by perpendicular, or overhanging cliffs, are referrable to *cumulo-stratus*—whatever, in short, we remark, amidst the light and shade which diversify the magnificent, and often truly mountainous, scenery of the sky."

This form of cloud is also common where rain very frequently falls in the higher parts of the mountains; but is seldom seen in the valley, except during the rainy season.

"The *nimbus* is the cloud in which the electricity of the atmosphere is most fully manifested. From its connection with local showers, this cloud is distinguished almost exclusively by bearing in its broad field of sable the honours of the rainbow."

This form of cloud is seldom seen except during the winter months, when it is very common, presenting the most beautiful rainbows. With regard to the electric tension of the atmosphere, I should pronounce it to be very inconsiderable—both from the form of the clouds and the rare occurrence of thunder; seldom more than half a dozen times in the year, and that, during the rainy season. According to Dr. Heineken's account, the gold-leafed electrometer is very slightly acted upon. This is a most important subject, as regards the influence of climate upon the system. It is one, the thorough investigation of which appears to be a desideratum in the science of meteorology; and, nevertheless, no one seems to have taken it up with the energy it deserves. Hence, we are at a loss for precise data, to determine the effect which the atmosphere of different localities is calculated to produce upon the human frame. As concerns the climate of Madeira, it would be most interesting to know the kind and quantity of electricity which exists in the ordinary condition of the atmosphere, and during a *Leste;* as, from the effects produced on the body, I should say that this powerful agent varied greatly, both in quality and quantity, during those very opposite conditions of the air. I should strongly recom-

mend this subject to the consideration of future investigators of the climate of Madeira, as it is undoubtedly of primary importance, both in a philosophical and medical point of view. It is a subject fraught with the highest interest to the medical philosopher; for no one, in the present day, will deny that electricity plays a most important part, not only in the system of nature, generally, but also in every part of our wonderful and mysterious organization.

I shall now endeavour to give a general idea of the state of the ærial vault above the valley, south of the Island; and of the direction of the lower strata of clouds, as influenced by the land and sea breezes. At 6 a.m., the horizon, over the mountains to the north, is clear and of a blue-grey appearance; so, also, is a great proportion of the sky over the valley. The horizon, over the sea, is covered with a bank of yellowish white clouds of various forms and sizes, though not clearly detached from each other. To the east, there are, generally, clouds of this form, both over the sea and above the high lands. The west is ordinarily free from detached clouds. The banks of clouds, resting on the horizon, over the ocean, gradually ascend; and detached bodies make their appearance, coming in the direction of the land. These increase, progressively, during the day, as long as the sea breeze continues. About 9 a.m., clouds are seen to arise from above the mountains, resting over their summits; at first, detached; but, gradually uniting, until a large

bank is formed. They are either of a yellowish white, or light Indian-ink tint; and progressively accumulate until half the valley appears covered; when they begin to detach and separate into distinct forms, leaving portions of clear blue sky, of various sizes and shades of colour. From 11 till 12 a.m., the whole vault is, generally, obscured; so that very little sky is to be seen. These clouds are stratified; yet do not present one uniform sheet, but a congeries, at different elevations, and of various densities.

The stratum, coming from the north to the sea, is at the greatest elevation; that from the sea is lower; and both attain the zenith about noon, and cross each other.

This cloudy condition continues till about 3 p.m., when it separates into distinct forms; slight fissures of blue make their appearance, and gradually enlarge; the higher clouds having passed over the ocean, while the lower has ascended over the valley; finally rest on the tops of the mountains, which are of a dark Indian-ink tint. At 5 p.m., a fair proportion of light blue, or blue-grey sky is to be seen over the valley, and the horizon, over the sea, is free from accumulated clouds; having one uniform stratum of a blueish-white colour.

Soon after 5 p.m., the dark clouds from the north begin to descend, and pass over the valley. From 6 to 7 p.m., the whole vault is covered with heavy dark clouds, passing along with the land breeze towards the ocean. These clouds continue to move,

advancing, also, to the W. and S.W., till after 11 p.m.; when the tops of the mountains are distinctly seen, the stars appearing much clearer and brighter in the transparent night of Madeira than I have ever observed in England. Few stars are ever to be seen over the ocean, near the horizon, which is always more or less covered by a mass of vapour, of various degrees of density. This progression of the clouds alters, greatly, the power of solar radiation, which gradually increases from sunrise to 11 a.m.; at which period the maximum temperature is attained. From 11 to 3 p.m., the power of the sun decreases, owing to the cloudy state of the atmosphere; but, at 3 p.m., its force begins to increase; and continues to do so till 4 p.m., when it rapidly declines. At 5 or 6 a.m., the minimum temperature in the shade is attained; and, then, rises till 2 p.m., or half-past 2, when it attains its maximum.

The temperature generally remains stationary for an hour and a half or two hours; when it begins to decline, and progressively decreases till 5 or 6 a.m., or just before sunrise, being then at its minimum.

The maximum power of solar radiation is from 9 a.m. to 11 a.m. The maximum temperature, in the shade, is from 2 p.m. to 4 p.m.; when both begin to decline.

The progressive rise and decline of temperature, solar radiation, and humidity, will be better seen in the diagram, *Plate* IV.

In this description of the state of the sky, I may be considered, by many, to be unnecessarily prolix; but as such false and altogether pseudo-poetical views have been hitherto given, and appear to have gained universal credence, both with the profession and public, generally; it is high time to remove an erroneous impression, as it will be the means of preventing much disappointment to those invalids who may hereafter visit the Island, and whose ideas have been deluded by the description, previously given to the public,—particularly in a modern publication, so late as November, 1834—a work eminently calculated to inspire the mind with the most vivid and enthusiastic feelings, too soon, alas, to be dissipated, when the real picture meets the eye of the unfortunate stranger; whose mind, being filled with the idea that he is about to enter a perfect paradise, cannot bring itself to believe the plain matter of fact, without a pang of regret and disappointed hope.

"The beautiful and fertile island of Madeira," says the anonymous writer, "enjoys a situation, perhaps the most desirable on the whole globe, which enables it to combine all the *luxuries of climate with the comforts of civilisation.* There is a *peculiar clearness* in the atmosphere, with a *transparency* which seems to bring out fresh hues from every object, and *the sky, of a deep and stainless blue,* is UNSULLIED BY A CLOUD. The air is soft and delicious, and strikes with a peculiar charm the stranger, whom, perhaps, a few days have transfer-

red from the gloom and chill of an English winter. The Island is, also, singularly free from the annoyances and inconveniences, so common in warm climates; being subject to no epidemic fevers, and free from snakes or noxious reptiles of any kind, &c."

How far this is from the truth, will be seen from the above facts, as regards the meteorological part of the question; and the same will equally hold with respect to the "annoyances, inconveniences, &c.;" a detailed account of which has been so admirably given by my friend Mr. Blewitt, that further notice would be superfluous.

This friend informed me that he never failed in being able to distinguish the satellites of Jupiter; and had been gratified by witnessing both the strong shadow cast by Venus, and the various phases of that noble planet.

CHAPTER VI.

SUMMARY OF THE TABLES ON TEMPERATURE AND HUMIDITY, THROUGHOUT THE YEAR.

In the month of January, the mean temperature was at its minimum, in all particulars. The mean temperature was 60°.24; varying from 63°.23, the highest to 57°.26, the mean lowest—the utmost mean range of the thermometer, in the shade out of doors, being from 65° to 55°. The average maximum power of the sun was 22°.51, above the shade, and the utmost intensity of its rays 55°; its least maximum intensity being 62°, the absolute maximum 120°; giving a range of 58° during the month. The mean degree of dryness from 9 a.m. to 9 p.m. on the thermometric scale was 3°.10; 0° being the point of saturation. The mean maximum dryness was 3°.87, the maximum dryness, 6°; the minimum being 0°, or the point of saturation. The number of fine hours in the month, during the day, was 87; of cloudy or variable ones, 211; of rainy ones, 74; the last occupying part of 14 days.

In the month of FEBRUARY, the mean temperature increased to 61°.12, only the 88th of a degree. This accession took place while the sun was above the horizon, the mean maximum temperature rising to 64°.75, or 1°.52; while the mean minimum only advanced .24. This difference was owing to the increased influence of solar radiation, under a less clouded sky; the number of hours, fine, during the day, being 142—an increase of 55 over the preceding month—while the number of hours, cloudy or variable, had diminished in the proportion of 36, being only 173. Radiation had also increased during the night, the sky being clearer than in January.

The number of rainy hours were 21, which occupied part of 9 days. The mean maximum temperature of February was 64°.75; the mean minimum, 57°.50. The extreme range of temperature of the external air during the month, was, from 69°, the maximum, to 55°, the minimum; or 14°. The mean maximum power of the sun rose to 34°.50, or 11°.99 above that of January. The utmost intensity of its rays above the shade was 51°, 4° less than in January. The least maximum intensity was 75°, or an increase of 13°; the absolute maximum, 120°, giving a range of 45°.

The mean degree of dryness from 9 a.m. to 9 p.m. was 4°.26—an increase of 1°.16 over the preceding month. The mean maximum dryness was 5°.26. The maximum dryness advanced to 7° or 1°. The minimum, or point nearest saturation. also advanced to 1°.

In March, the mean temperature was 63°.43, varying from 68°.39, the mean highest; to 58°.48, the mean lowest—an increase of 2°.31, above February. It was still during the day that the heat chiefly accumulated; the day temperature advancing 3°.64, while that of the night only increased .98 of a degree. This rise of temperature accorded with the less cloudy state of the atmosphere. The number of hours, fine, during the day, being 156, or 14 more than in February; while those, cloudy or variable, decreased 59; the total number being 114. By referring to Table VI., it will be seen that there were 22 nights, generally fine, and only 4, cloudy or variable; an increase in the former of 6, and a decrease in the latter of 15; thus permitting greater radiation during the night, which sufficiently accounts for the slight increase of temperature; while, during the day, the heat accumulated, from the greater power of the sun; and from its rays not being so much impeded by the less cloudy state of the atmosphere. The number of rainy hours in the month, during the day, were 32, which occupied part of 8 days. The extreme range of the thermometer, in the shade, was from 71° to 53°.5, or 17°.5. The mean maximum power of the sun, above the shade, was 48°.49, and the utmost intensity of its rays, 71°; being an increase, in the former, of 13°.99, and, in the latter, of 20°, above February. The least maximum intensity was 80°, or an increase of 5°; the absolute maximum 142°, an increase of 22° above the

preceding month, giving a range of solar radiation of 62°.

The mean dryness was 4°.55. The mean maximum, 6°.13—a slight increase over February. The maximum dryness, advanced to 8°, or 1°; the point, nearest saturation, remaining at 1°, as in the preceding month.

In April, the mean temperature was 65°.39, varying from 70°.46, the mean highest, to 60°.33, the mean lowest; an increase of 1°.96 above March. It was, still, during the day, that the heat chiefly accumulated; the day temperature advancing 2°.07, while the night had only advanced 1°.85 over March. The extreme daily range varied from 75° to 58°, or 17°. By referring to Table VI., it will be seen that this slight rise of temperature during the day, and the greater proportionate rise during the night, over the preceding months, was entirely referrable to the same causes, viz.—the difference arising from a greater or less quantity of aqueous vapour in the atmosphere. According to the sun's altitude, there ought to have been a greater rise of temperature during the day, over the preceding month; which we see was not the case. This arose from there being more cloudy weather. The greater increase of temperature, during the night, was also referrable to the more cloudy state of the sky, thus preventing terrestrial radiation. It will be found by the table that there had been only 137 hours, fine, during the day in the month—a decrease of 19 over March; while there was an increase of

46 hours, more cloudy; the total number being 160. In this month there were 10 nights generally cloudy; whereas, in March, there were only 4; the number of rainy nights being the same in each. The number of rainy hours during the day were 63, extending over 10 days.

The mean maximum power of the sun, above the shade, in April, was 50°.20, and the utmost intensity of its rays 87°; being an increase, in the former, of 1°.71; and in the latter, 16°, above March. The least maximum intensity was 88°, being an increase of 8°; the absolute maximum was 162°, an increase of 20°; giving a range of 74°, for solar radiation. The mean dryness was 3°.26, a decrease of 1°.29; the mean maximum, dryness 4°.63, a decrease of 1°.50. The maximum dryness remained at 8°, while the minimum attained the point of full saturation, being at 0°. The mean dryness of this month was the least in the year, with the exception of January, November, and December.

In May, the mean temperature was 67°.97, varying from 72°.60, the mean maximum, to 63°.35, the mean minimum; giving an increase of 2°.58 above April. In this month the heat had accumulated, chiefly during the night, advancing 3°.02 above the mean minimum of April; while the day temperature had only advanced 1°.97 over the mean maximum of the same month. The extreme range of temperature, during the month, had been 16°.5, varying from 77°.5 the maximum, to 61° the minimum. The mean maximum power of the sun's

rays rose to 53°.17 or 2°.97 above April. The utmost intensity of its rays, above the shade, was 92°.5, an increase of 5°.5, above April. The least maximum intensity was 74°, a decrease of 14°. The absolute maximum rose to 170°, being the maximum power of solar radiation, during the year; and giving a range of 96° for the month—the greatest range I observed.

The mean degree of dryness from 9 a.m. to 9 p.m. was 4°.10, being an increase of .84, over April; while the mean maximum advanced 1°.28, having risen to 5°.91. The maximum dryness was 9°, having attained its greatest degree; while the minimum continued the same as the preceding month, viz, at 0°. The number of hours, fine, in the month, during the day, was 218, an increase of 81 above April; of cloudy, or variable ones, 130, a decrease of 30; of rain during the day, 24 hours, which occupied two days. The nights were much the same as during the preceding month; though, on the whole, more clear in the early part of the evening; yet not sufficiently so as to dissipate the accumulated heat of the day, the power of solar radiation being great. Consequently, we found an increase of temperature at the night, over the preceding month.

In June, the mean temperature was 69°.44, varying from 73°.16, the mean highest, to 65°.73, the mean lowest; giving an increase of 1°.47 above May. In this month the heat had accumulated, chiefly during the night; advancing 2°.38 above the mean

minimum of May; while the day temperature had only advanced .56, over the mean maximum. The extreme range of temperature, during June, was 17°; varying from 80°, the maximum, to 63°, the minimum.

The mean maximum power of the sun above the shade was 52°.08; the utmost intensity of its rays, 90°; being a decrease, in the former, of 1°.09, and, in the latter, 2°.5 below May. The least maximum intensity was 78°, an increase of 4°; the absolute maximum being 170°—the same as last month—and, giving a range of 92°; a decrease of 4° over the preceding month. The mean degree of dryness was 4°.51; an increase of .41, over May; while the mean maximum had decreased .6; being 5°.85. The maximum dryness was 9°; while the minimum had advanced to 2°, being at 0° in May.

The number of hours, fine, in the month, during the day, was 163—a decrease of 55 below May; of cloudy or variable, 157; an increase of 27; of rain, during the day, 40, which occupied six days; being an increase of 16 hours more of rain, than occurred in May. The days appeared to have been much more cloudy than in May; which accounts for the very slight increase of temperature; a great portion of the sun's rays being obstructed in their passage to the earth's surface by the denser state of the atmosphere; while the cloudy sky, during the night, preventing terrestrial radiation to a great extent, satisfactorily explains the continuance, of the increase of temperature, during the night.

In July, the mean temperature was 71°.68; varying from 75°.06, the mean highest, to 68°.29, the mean lowest; giving an increase of 2°.24, above June. During this month, the increase of heat became more equally distributed; advancing 1°.90, in the day, and only 2°.56, during the night, over the mean maximum and minimum of June. This gives a rise of temperature of 1°.34 in the day, more than the preceding month gave over May; and only the 18th of a degree, during the night. The extreme range of temperature was reduced to 14°, ranging from 80° to 66°.

The mean maximum power of the sun, above the shade was 55°.45, and the utmost intensity of its rays 72°; being an increase, in the former, of 3°.37 over June, with a decrease of 18°, in the latter. The least maximum intensity of the sun's rays was 86°, being an increase of 8°; the absolute maximum 152°; a decrease of 18°, below its intensity in June; thus reducing the range of solar heat to 66°, or 26°.

The mean dryness was 4°.95; the mean maximum 6°—a slight increase over June. The maximum dryness remained at 9°; and the point, nearest saturation, at 2°.

The number of hours, fine, in the month, during the day was 156; a decrease of 7, below June; of cloudy or variable, 210; an increase of 53 over June. No rain fell, during this month, and the nights were, generally, less cloudy; which accounts for the slight increase of temperature.

In August, the mean temperature was at its maxi-

mum being 72°.78; varying from 76°.93, the mean highest, to 68°.48, the mean lowest; giving an increase of 1°.10, above July. It was during the day that the heat chiefly accumulated in this month; the day temperature advancing 1°.87, while the night only advanced the 35th of a degree, over July. The extreme range was the same as last month, being 14°, varying from 80° to 66°.

The number of hours, fine, during the day, was 243; an increase of 87 above July; of cloudy or variable, 124; being 86 less than the preceding month; which sufficiently accounts for the increase of temperature during the day. There had been only 5 hours' rain in the day, during the month—occurring on three days. It appears, from the tables, to have been more cloudy during the night; the mean terrestrial radiation being only 2°.60, the maximum 7°.

The mean maximum power of the sun, above the shade, was 65°.78, the maximum during the year; the utmost intensity of its rays 82°; being an increase, in the former, of 10°.33; and, in the latter, of 10°, above July. The least maximum intensity was 90°; an increase of 4°; the absolute maximum 162°, being an increase of 10°. The mean dryness was 5°.85, the mean maximum 6°.05; a slight increase, in each, over July. The maximum dryness decreased 1°, standing at 8°; while the minimum advanced 1°; the point, nearest saturation, being 3°.

In September, the mean temperature was 72°16; varying from 76°, the mean highest, to 68°32, the

mean lowest; being a decrease of .62. This decrease took place, chiefly, during the day; amounting to the 93rd of a degree, below the mean maximum of August; while the night temperature had only decreased the 32nd of a degree. The extreme range, during the month, was only 13°; varying from 79°, the maximum, to 66°, the minimum.

The number of hours, fine, during the day, was 195; a decrease of 48; while the number of hours, cloudy or variable, had increased to 140; being 16 more than the former month.

There were five days in which rain occurred; the number of hours being 25. By reference to the tables it will appear to have been clearer during the night, although more rain fell; the mean terrestrial radiation advancing to 6°.25, or 3°.65, while the maximum effect was 8°; an increase of 1°.

The power of the sun had decreased in all particulars; the mean maximum, above the shade, being 54°.65, and the maximum effect 77°; giving a decrease of 11°.13, in the former, and 5° in the latter. The least maximum intensity was 82°; a decrease of 8°; the absolute maximum, 156°; a decrease of 6°. In this month the humidity began to increase; the mean dryness being 4°.21, a decrease of 1°.64. The mean maximum was 5.°28; a decrease of 0°.77. The maximum dryness was 7°; a decrease of 1°; while the minimum was reduced to 1°, nearer the point of full saturation.

In OCTOBER, the mean temperature was 69°.49, varying from 73°.06 to 65°.93; being a decrease of

2°.67, below September. This decrease was almost equally divided, between day and night; being 2°.94, below the mean maximum of the former, and 2°.39, below the mean minimum of the latter. The extreme range of the thermometer in the shade was 15°—from 77°, the maximum, to 62°, the minimum.

The number of hours, fine, during this month, was 135; a decrease of 60: of cloudy or variable, 134; a decrease of 6 hours. Much rain fell, during this month; there being 103 hours' rain, during the day—an increase of 78 hours, which occurred in the space of 10 days; this being the number of days, during which rain fell.

The nights were about equally divided between fine and cloudy; but there were seven nights, for the most part, rainy.

The mean terrestrial radiation was 5°.70; a decrease of .55; while the maximum effect remained the same as last month, viz., 8°.

Thunder and lightning occurred, during three nights; rather powerful, but not so, as to produce any mischief. The mean maximum power of the sun, above the shade, had decreased to 38°.44, viz., 16°.21; while its maximum effect was 62°; being a decrease of 15°. The least maximum intensity of its rays was reduced to 64° or 10°, while the absolute effect was 139°; a reduction of 27°, below September; giving a range of 64° of solar heat. The mean dryness was 3°.46; a decrease of .75. The mean maximum dryness, 4°.15; a decrease of 1°.13.

The maximum dryness was 6°; a decrease of 1°; while the minimum was at 0°, or the point of saturation.

In November, the mean temperature was 65°.45; varying from 68°.70, the mean highest, to 62°.20, the mean lowest; giving a decrease of 4°.04, below October. This decrease was nearly equally divided between day and night; being 4°.36 below the mean maximum of the former, and 3°.73 below the mean minimum of the latter. The extreme range of the thermometer in the shade was 16°; ranging from 73°, the maximum, to 57°, the minimum.

The number of hours, fine, was 114, a decrease of 21; while those, cloudy or variable, increased to 167 or 33. The number of hours, rainy, also decreased during the day, being 79, which occupied 18 days; whereas, in October, there were 103 rainy hours in 10 days.

The nights were generally less fine, and more cloudy and rainy than in October, though the mornings were more clear; which accounts for the increase of radiation; the sky being free from cloud, after the heavy rains. It appears, from the Tables, that there were 10 nights generally fine—a decrease of 8 below October; 13 generally cloudy—an increase of 5; with 7, generally rainy, but more heavily and continuedly so, than in the last month.

The mean terrestrial radiation was 6°.—a slight increase over October; while the maximum effect increased 2°, being 10°. Thunder occurred during 3 nights, though not so violent as in October.

The mean maximum power of the sun, above the shade, had increased to 46°.90, viz., 8°.46. Its maximum effect was 73°, being an increase of 11°. The least intensity of its rays was 76°, a rise of 1°; while the absolute effect was 146°; an increase of 7°, giving a range of 70° of solar power.

The mean dryness was reduced to 2°.17—a decrease of 1°.29. The mean maximum dryness was 2°.75, being a decrease of 1°.40. The maximum dryness was 6°—the same as in October—and the minimum remained at the point of saturation.

In DECEMBER, the mean temperature was 64°.25; varying from 66°.80, the mean highest, to 61°.71, the mean lowest; giving a decrease of 1°.20, below November. This decrease took place, principally during the day, when it reached 1°.90; while the highest temperature had only decreased the 49th of a degree. The extreme range was 17°; reaching from 72°. the maximum, to 55°, the minimum.

The number of hours, fine, was 108, a decrease of 8; of cloudy or variable, 208—an increase of 31; while the number of rainy hours decreased 23, being 56, which occupied 10 days.

The nights were more fine, increasing 6; while there were 5 of decrease, in cloudy and variable weather, and 3, of rainy; thunder occurring during one night, only. The mean terrestrial radiation was 5°.48, the maximum 15°—or an increase of 5°.

The mean maximum power of the sun decreased to 32°.71, viz, 14°.19. Its maximum effect was 53°—a decrease of 20°, below the preceding month.

The least maximum intensity of its rays was 70°—a fall of 6°. The absolute maximum was 125°, a decrease of 21°, below November; giving a range of solar radiation, of 55°.

The mean dryness was 2°.52, being an increase of 0°.35. The mean maximum dryness was 3°.25—an increase of .50. The maximum had advanced 1°, while the minimum remained the same; the former being 7°, the latter, 0°.

The mean temperature of December was 4°.01, above January; the mean maximum, 3°.57; the mean minimum, 4°.45. The mean maximum power of the sun, above the shade, was 10°.20 above January; and the maximum effect, 2°, lower. The maximum power of the sun was 5°, the least maximum effect 8°, above January.

The mean dryness was .58 less than in January; while the mean maximum was .62, less. The maximum dryness was 1°, above; while, in both, the minimum was at Zero.

CHAPTER VII.

GENERAL OBSERVATIONS ON THE TABLES.

SECTION I.

ON SOLAR RADIATION.

Before dismissing the subject, a few observations, with respect to solar radiation, will not be misplaced; as my observations, at Madeira, are at variance with the inferences of Professor Daniel, on this subject.

From his experiments, he concludes that "the force of the sun's direct radiation decreases, as we approach the equator; and increases, as we advance towards the poles." In another place he observes, "It is not the absolute heat of the sun which increases from the equator to the poles; but the difference, between the direct rays and the shade, increases."

As a proof he gives the following experiments:—

EXPERIMENTS UPON SOLAR RADIATION, AT BAHIA, ON THE COAST OF BRAZIL.

Month.	Sun.	Shade.	Difference.
July 24	114°	82°	32°
„ 25	123	82	41
„ 26	124	83	41
„ 27	123	83	40
„ 28	95	78	17
„ 29	115	78	37
„ 30	127	80	47

With regard to this Table he observes, that the maximum effect was only 47°, with nearly a vertical sun; while the same influence, in our temperate, climate in June, in a medium, not much less heated, was 65°. "At Melville Island, near the North Pole, the sun had power to raise a thermometer, which had not been prepared to receive its greatest impression, 55°, in the month of March; while the maximum effect, in the vicinity of London, in the same month, upon a thermometer covered with black wool, was only 49°." He also mentions some of Captain Scoresby's experiments, in the Arctic regions; where the thermometer, in the direct rays of the sun, stood at 120°, while ice was forming in the shade; giving a difference of 90°.

By referring to the Tables II., III., IV., and V., upon solar radiation, it will be clearly seen, that both the mean and maximum power of solar radiation are considerably greater at Madeira, than in

London; the mean of the year, in the latter, according to Mr. Daniel's Tables, being only 22°.5; while, in the former, it is as high as 46°.24. The mean maximum at Madeira is 71°.87; in London only 43°.58.

The mean maximum effect of solar radiation, above the shade, in London; is, in June, 39°.9; the maximum effect being 65°. In Madeira, the mean maximum effect takes place in August, and is 65°.87 above the mean maximum of the shade; the maximum effect being, in May and June, 92°.5, in the former; and 90°, in the latter. The actual power of the sun is also greater at Madeira, than in London. From Mr. Daniel's Tables, it appears that the greatest height of the thermometer, in the sun, is 154°; whereas I have seen it, in Madeira, as high as 170°. Both these circumstances will be more apparent on referring to *Plate* III.; which shows the respective temperatures of the sun and shade, by means of lines, for the 3d May, 1834, when the power of the sun was at its maximum or 170°; while the thermometer in the shade only indicated 72°—a difference of 98°. The mean annual difference will be, also, better ascertained by consulting Tables IV. and V. In London, the mean maximum temperature in the shade is 56°.1; the mean maximum temperature, in the sun, 78° 6; giving a difference of 22°.5. In Madeira the mean maximum of the shade, for the year, is 70°.30; the mean effect of solar heat, 116°.54—a difference of 46°.24—and 23°.74 greater at Madeira, than in London.

It will also be seen, that, although the mean range of temperature, in the shade, in Madeira, is much less, and is more equally distributed throughout the year, than in London; the effect of solar radiation is just the reverse—the range being much greater, and more unequally distributed in the former than in the latter. In Madeira, the range of temperature, in the shade, from day to day, is very small; whereas the solar range is very considerable—the maximum effect often varying, from day to day, not less than from 50° to 60°. The range, during the same day, is also very great, as will be seen in *Plate* III.; the range in the shade being only from 65° to 72°.7; whereas, in the sun, from 9 a.m. to 6 p.m., the temperature varies from 81° to to 170°—giving a range of 89°.

As regards the very feeble power of the sun's rays, in raising a thermometer, suspended in the air at some distance from the ground, above the temperature of the shade; my experiments confirm those of Humboldt; who observes, "at Cumana I have often endeavoured to measure the power of the sun by two thermometers of mercury, perfectly equal, one of which remained exposed to the sun, while the other was placed in the shade. The difference resulting from the absorption of the rays in the ball of the instrument never exceeded 6°.6 Fahrenheit; and sometimes did not even rise higher than 1° or 2°." How near my experiments in Madeira approach to this, will appear from the following table—especially, if we bear in mind

that the thermometer, in the shade, was subjected to slight radiant heat, which would somewhat raise its temperature; and the one, suspended in the air, to the reflected light and heat, from the white buildings in the vicinity.

The thermometer, in the shade, was in the situation formerly described; the one for ascertaining the full effect of solar radiation, being one inch from the ground.

The thermometer, by which the effect of the sun's rays in the air, was ascertained, was suspended by a thread; the bulb of the instrument being five feet from the ground, and naked.

In the following experiments, the sun was always bright, not being the least obscured by clouds, so that the full effect was obtained:—

Month and day.	Hour of observation.	Thermometer on the ground.	Difference between thermometer on ground and shade.	Thermometer in the shade.	Thermometer suspended in the air.	Difference between thermometer in the shade and suspended in the air.
August 9th	10 a.m.	120°	47°	73°	82°	9°
,,	11 a.m.	145	71	74	86	12
,,	noon.	156	80	76	86	10
,,	2 p.m.	152	73	79	90	11
,,	3 p.m.	155	76	79	87	8
10th	9 a.m.	137	65	72	80	8
,,	10 a.m.	135	62	73	80	7
,,	11 a.m.	148	73	75	87	12
,,	noon.	162	86	76	88	12
,,	1 p.m.	164	87	77	89	12
,,	2 p.m.	166	87	79	84	5
,,	3 p.m.	137	58	79	86	7

From this Table, it will be seen, that the mean variation, between a thermometer, suspended five

feet from the ground, in the direct rays of the sun; and another, in the shade, was only 9°.416; whereas the one, situate one inch from the ground, varied 62°, during the same periods. There was, also, a great difference between the range of the thermometers, during the same periods; that in the shade, only ranging from 72° to 79°, or 7°; the one, in the direct rays of the sun, and suspended five feet from the ground, from 80° to 90°, or 10°; while the one on the ground varied from 120° to 166°, or 46°.

During the 11th of the same month, when the sun was obscured by clouds, very little change took place in the thermometer, in the shade; or in the one which was suspended in the air; but the decrease of temperature, in the radiant thermometer, on the ground, was considerable; showing either how soon, during the day, the heat radiates back again to the great expanse; or how rapidly it is absorbed by the earth; being as high as during the preceding day, when the sky was unclouded, at the time of making the observations.

Hour.	Thermometer on ground.	Thermometer suspended in the air.	Thermometer in the shade.	Remarks.
10 a.m.	155°	82°	74°	Sun unclouded.
11 a.m	118	80	74	Sun obscured by clouds.
noon.	112	80	74	
3 p.m.	98	80	76	

A second series of experiments was made; the bulb of the suspended thermometer being covered

with white silk. The mean of the same number of observations, made under similar circumstances, gave a difference of 1°; being rather more than 10° above the shade.

These results come very near to those of Humboldt, considering that the experiments were not made under the most advantageous circumstances; the thermometer in the shade being subjected to slight radiant heat, while the one that was suspended in the air, also suffered, on account of the light and heat, reflected from the surrounding white buildings.

SECTION II.

FAIR AND RAINY DAYS. OBSERVATIONS ON TABLES VI. AND VII.

THESE tables were constructed to show, as far as it was possible, the actual time that was either fine, cloudy, or rainy. Preceding observers on climate have only made very cursory remarks on the subject—such as the number of days on which any rain fell—so that the whole day, provided a strong shower of rain fell during any part of it, would be set down as rainy, although there were but two or three hours of actual rain; the greater part of the day being either fine, or cloudy.

This is a very unfair method of judging, especially in climates, subject to frequent occasional showers; as the number of days on which rain fell

might be very considerable, although the actual time of rain was very limited—provided the hours, only, were taken into the estimate.

To give an example:—In Table VI., in January we see there were 74 rainy hours, making 6 days 2 hours; and that this was distributed over 14 days.

The same has been done with regard to fine and cloudy weather. In January there were 87 hours, or 7 days and 3 hours, of fine weather, distributed over 14 days; and 211, cloudy or variable, or 17 days 7 hours, distributed over 26 days.

Thus it will be seen, at once, what time an invalid could have taken exercise, &c., during any month of the year; and this method will show, most effectually, the real condition of the weather, in any climate.

The same has been done for the seasons and for the whole year in Table VII.; from which it will appear that there were 44½ days of 24 hours, rainy throughout; and that these were distributed over 101 days and 55 nights; and that the number of hours, cloudy and rainy, exceeded that of those which might be considered tolerably clear, in the proportion of 48 days, throughout the whole year.

The observations, during the day, may be strictly depended upon, for their correctness; but some allowance must be made for the night, as it is evident that such observations can only *approach* the truth. The 24 hours were equally divided, viz., 12 hours day, from 6 a.m. to 6 p.m.; and 12 hours night, from 6 p.m. to 6 a.m. This division,

though arbitrary, is the best suited to the climate of Madeira; for few invalids will be tempted to take exercise before 6 a.m.; and, as it is dark from 6 to 7, or a little after, it would be, then, impossible, provided other circumstances did not render it imprudent.

SECTION III.

OBSERVATIONS ON THE TABLES OF HUMIDITY.

Professor Daniel observes that "the average quantity of vapour, in the atmosphere, decreases from below, upwards; and that the elasticity of the aqueous vapour does not decrease gradually, as we ascend in the atmosphere, in proportion to the gradual decrease of temperature and density of the air; but that the dewpoint remains stationary, to great heights, and then suddenly falls to a large amount; and that we have presumptive evidence to draw the conclusion, that there may be an immense bed of vapour immediately above the earth's surface, rising on its circumambient medium, unaffected by decrease of density and temperature, till checked by its point of precipitation; and that possibly there may be an incumbent bed, of not much more than one-third the density, regulated, as the last, by its own point of deposition in loftier regions." I have not made many hygrometrical experiments, with the view of establishing

this fact; but, from the appearances of the land and atmosphere, on my departure from Madeira, I am quite convinced of the accuracy of Professor Daniel's observations.

The first appearances which attracted notice, occurred about eight miles from land, when there seemed to be three distinct strata of vapour The first occupied a space of about 2,500 feet, forming a regularly defined line of cloud, very dense, and appearing to occupy about half the space of the lower stratum. This assumed the form as of a thick haze; so that the town and Mount Church, with the ridge of the lowest mountains, could be but indistinctly seen.

The second stratum of vapour was white and dense, so that not any trace of land could be observed.

The third stratum appeared very thin and attenuated; so that the high land was distinctly seen, without any appearance of haze. These strata did not gradually run into each other, but were separated by well-defined lines; whence no doubt rested upon my mind, that the first was an immense bed of vapour, the humidity or distance from the point of saturation of which, will be indicated by the Tables that relate to it.

The second stratum is the first point of precipitation, produced by the depression of temperature in loftier regions. This surrounds the Island, as a girdle, and occupies the space about the *Curral;* as, when you are at the highest point above the valley,

or from 4,000 to 4,500 feet above the sea, you see the clouds almost constantly passing beneath you; while, above, it is comparatively clear, and, as it were, devoid of clouds.

The second appearance, worthy of notice, occurred at the distance of about twelve miles; the town and all the lower land being invisible. There now appeared four distinct strata, with well defined lines. The lowest was the most dense; being of a blue-grey colour, and occupying double the space of the two that were next to it. The second was less dense, and appeared more white and translucent than the one beneath; but no trace of land could be seen through it. This occupied about half the space of the other. The third was still less dense, appearing as a thin haze; the mountain peaks being distinctly seen. This extended a little above the summits of the highest mountains. The fourth stratum was of a clear yellow-tinted white, still more attenuated. It seemed to be connected with the clouds over the ocean, and occupied a space, nearly double that of the two, last described.

These appearances bear upon the experiments of Professor Daniel; and tend to elucidate, by ocular proof, the paragraphs, above quoted from his excellent work on meteorology.

The hygrometrical observations, made near the sea—the result of which is given in Table XXIX.—would tend to contradict this opinion, if compared with those in Table XX., made at an elevation of 300 feet; as, from these, it appears that the mean

dryness between 9 a.m. and 9 p.m. was in favour of the lower part of the town; being, in March, .70, in April 1°.36, and in May, .74, dryer than at Sta. Luzia, 300 feet above the sea; while the maximum was 1° higher in March and April; the minimum, the same in April, but 1° higher in March and May. But, taking into the estimate the dryness from 6 a.m. to 9 p.m., the mean dryness will be nearly the same in both situations; as 6 a.m. is drier at Sta. Luzia than at Mrs. Mair's Lodgings, near the sea, while at 9 a.m. the dryness is in favour of the latter—the sea breeze having passed over the lower part of the town, and arrived at Sta. Luzia; which accounts for the increased humidity of the latter, as well as the greater dryness of the former, at that hour.

By this calculation the mean dryness of the town is only .13 above that, at Sta. Luzia.

The experiments, made with the hygrometer at both situations, tend to confirm this conclusion; as the irregularity, observed, is entirely referrable to local causes, for which we can account; for, had there been a gradual increase of humidity, from the level of the sea to the heights above, it would have been more manifest, than the small decimal appears to indicate.

"The condensation of elastic vapour, into cloud, raises the temperature of the air."—*Daniel.*

Nothing is more clear than this, in Madeira, when the land breeze commences; and the clouds, condensed by the depression of temperature, after sun-

set, pass over the valley to the ocean. The temperature, in the shade, attains its maximum from half-past two to three p.m., remains stationary, for nearly two hours, and then decreases till sunset; when it either remains, again, stationary, or rises one or two degrees before 11 p.m. It again decreases till a little before sunrise, when the minimum temperature, which is, invariably, in proportion to the cloudiness of the evening and the distance from the point of saturation, is attained.

SECTION IV.

TERRESTRIAL RADIATION.

"The force of radiation, for the given temperature, is less between the tropics than in the latitude of London."—*Daniel.*

My observations on this subject—although very limited—appear to confirm the above opinion. The maximum terrestrial radiation, in the clearest evening in Madeira, being only 15°; whereas, in London it is 17°, below the minimum temperature of the shade.

While treating upon the subject of humidity, I must not forget to comment upon one or two passages in Dr. Heineken's paper on the climate of Madeira; as they appear to have made a very great impression on the public. He observes that "at the level of the city, no *perceptible dew is produced;* but, up the mountains, it is profuse."

Nothing can be more erroneous than this statement; as, when the nights are at all clear, the quantity of precipitation is immense; so that, by exposing a common-sized dinner-plate, in a clear evening, several drachms of fluid may, at any time, be collected in only a few hours; while the shrubs and ground-plants are quite wet with moisture, as from a strong shower of rain; and frequently remain in that condition till after eight o'clock the following morning. My friend, Mr. Blewitt* has, also, confirmed this fact by experiments upon the higher ground; and the same results take place at Sta. Luzia. Indeed, I could scarcely say whether the quantity of precipitated moisture, collected at the latter place, was greater, or less, than what I observed during my residence at Mrs. Mair's Lodgings, near the level of the sea. Add to this, Dr. Heineken's remark, a little above, when speaking of hygrometrical observations, "that to make an observation after sun set *was at least nine months in twelve* INCOMPATIBLE WITH HEALTH." Why? Not from a great depression of temperature; for, by the tables, it will be seen that the range of the thermometer is inconsiderable; and that the temperature does not decrease, very much, till an hour or two before sunrise. There is no other cause, then, that I know of which would be at all incompatible with health, except the great humidity and precipitation of va-

* The present amiable and accomplished Secretary of the Literary Society.—ED.

pour; which Dr. Heineken appears to have *felt*, but to have entirely overlooked. To patients, who suffer from a humid atmosphere, and, nevertheless, adopt Madeira as a residence, the high ground, to the East or West of Funchal, will certainly afford the least unfavourable locality. The air of the East ridge is universally allowed to be the driest in the South of the Island.

By referring to Table XIX., it will be perceived, that the mean annual dryness, at 6 a.m. is greater than at 9 a.m.—the period at which the sea breeze sets in; and that, from this time, the dryness gradually increases, in proportion to the advance of temperature, until the maximum is attained; which occurs a little before 3 p.m., when the maximum dryness is also attained. It then remains stationary, until the temperature begins to decrease; when the humidity increases in proportion to the depression of temperature.

The same process takes place, during the year, as may be seen in Table XX.; the mean dryness increasing in proportion to the rise of temperature, and being at its maximum in August; and, then, gradually declining, as the mean temperature decreases in the following months.

CHAPTER VIII.

TEMPERATURE OF WELLS, SPRINGS, AND SEA.

REMARKS ON THE TEMPERATURE OF THE SPRINGS, WELLS, AND SEA, MADE AT FUNCHAL, MADEIRA, IN THE YEARS 1834—5.

Much has been said with respect to springs, as indicating the mean temperature of the year; and some have gone so far as to state that one observation was sufficient; and that it was great folly to be at the trouble of making repeated and daily observations on the temperature of the air, in the shade, when the fact could be so easily and satisfactorily ascertained by merely making one or two experiments. How far this is the fact, in level countries, I am not prepared to state; but, at Madeira, such a mode of proceeding, could, by no means, be depended upon, as the following observations on the temperature of the wells, springs, &c., of that place will prove. These observations will, also, illustrate the commonly received opinion, which

ascribes springs to water, deposited from the atmosphere on the higher grounds, and passing through the earth, as a filter; till, being arrested by an impermeable stratum, it flows along the surface of that stratum, and, either bursts out, in springs, or is intercepted by pits or wells, dug for that purpose; so that, in mountainous countries, much will depend upon the elevation from which the water descends; while the temperature of wells, near the level of the sea, will be found to be in proportion to the altitude of the place, where the water was first deposited, and to their distance from it.

This being a subject with which I am not, at present, very familiar, I shall not offer any comment upon the experiments, but shall leave, to more experienced investigators, the conclusions which may be deduced from them. Feeling the importance of such data, as regards the scientific world, I am tempted to publish the facts which I have observed.

Mr. Kirwan states "that at a certain distance from the surface, viz., 80 to 90 feet,—if this depth has any communication with the open air, and, perhaps at a much less depth, if there be no such communication—the temperature of the earth varies very little, and generally approaches the mean annual heat."

Thus, the temperature of springs would seem to be nearly the same as the annual temperature, and to vary very little at the different periods of the year, as Mr. Hellant first observed. These conclusions I consider too general; as more than is

commonly imagined, depends upon the locality and general bearings of the country in which such experiments are made. According to such a theory you might take the mean temperature of springs at different elevations, and conclude that you would thereby arrive at what obtains, on a level with the sea—which no one of the present day would be induced implicitly to believe.

The wells in Funchal, may be divided into four classes—three of which are situated in the lower part of the town, near the sea, and the fourth on the higher part. Each of these varies in temperature; the first and third being much colder than the second, which lies between the two.

In the first class, the water is rather brackish; in the second it is good, but many degrees warmer, the temperature remaining stationary; while the third, situated on the east side of the river Nossa Sna. do Calhão, is considered, by the inhabitants, as affording the best water; its temperature being colder than that of the two preceding classes, and varying throughout the year. In the fourth class, the wells are situated at a greater distance from the sea; their temperature being intermediate, and also variable.

The first class includes the wells, between the rivers Ribeiro Seco and Ribeiro de São João.

The second class, those, between the Ribeiro de São Joao and Ribeiro de João Gomez.

The third class consists of those that lie at some distance, East of the latter.

The first, second, and third classes of wells are found in the lower part of the town and in the vicinity of the sea. The fourth class, in the higher part of the town.

The distance of the rivers from each other is as follows, proceeding from West to East:—viz., from Ribeiro Seco to Ribeiro de São João, half a mile; from Ribeiro São João to Ribeiro de Sta. Luzia, half-a-mile; and from Ribeiro de Sta. Luzia to Ribeiro de João Gomez, about five hundred yards.

FIRST CLASS.

No. 1.—*San Lazaro.* This well is 14 feet deep, and lies a little to the west of Ribeiro de São João, about 80 yards distant from the sea, and only a few feet above its level. The water of this well is not used, although I could perceive no disagreeable flavour in it.

No. 2.—*Limekiln Well*, near Mr. Hally's. This well is 24 feet deep, lies about 40 yards West of the former, and is a few feet more elevated. This well is used, but the water tastes rather brackish.

SECOND CLASS.

No. 1.—*Mr. Blackburn's Well.* Depth, 18 feet; 500 yards from the sea, and from 15 to 20 feet above its level.

No. 2.—*Mr. Ellicot's Well.* Depth, 22 feet; 160 yards from the sea, and lies 18 feet above its surface.

No. 3.—*Mr. Grant's Stores Well.* 12 feet deep; situate 100 yards distant from the sea, and from 10 to 15 feet above its surface.

No. 4.—*Mr. Phelps's Well.* 21 feet deep; lies about 500 yards from the sea, and about 50 feet above its surface.

THIRD CLASS.

No. 1.—*Blacksmith's-shop Well.* Depth, 20 feet; situate 500 yards from the sea, and about 50 above its level.

No. 2.—*Mr. Alexander Cunha's*—Brandy Distillery. Depth of the well, 24 feet.

No. 3.—*Mr. Cairns's Well.* Depth, 24 feet.

These three wells lie in the same line, and not far distant from each other.

Nos. 4 & 5.—*Mrs. Mair's, Rua Sta. Maria Nova.* Higher well, depth 28 feet; lower, 18 feet. These two wells are about the same depth, and lie in a garden surrounded by a wall, 10 feet high—the depth of the high well being taken from the surface of the garden. They lie about 400 yards from the sea, and about 40 above its surface.

No. 6.—*Mr. Francisco's Well,* opposite Mrs. Mair's—about 40 yards nearer the sea, and 8 feet nearer its level. Depth of well, 25 feet.

No. 7.—*Public Well*, near Ribeiro N. S. do Calhão. Depth, 21 feet, on a line with Mr. Francisco's.

No. 8.—*Mrs. Rosa's Well*, *Rua dos Pangueiras.* Depth, 30 feet. This well is on a level with Mr. Cairns's, about 40 yards distant, and 45 yards from Ribeiro N. S. do Calhão.

No. 9.—*Mr. Miguel Carvalho's*, *Roxinha de Baxo.* Depth of well, 30 feet. This well is on the same level as the above, being 75 yards distant from it, or 120 yards from the above river.

FOURTH CLASS.

No. 1.—*Mr. Grant's Well*, near St. Peter's Church. Depth, 25 feet; lies about a quarter of a mile from the sea, and about 70 or 80 feet above its surface.

No. 2.—*Mr. Grant's Wine-Stores' Well*, in the same locality as the above, but about 20 or 30 yards nearer the sea. Depth, 36 feet. The water of this well is not used.

No. 3.—*Mr. Montero's Well*, above the *Pontinha*, situated from 3 to 400 yards from the sea, and 130 feet above its level.

Mr. Young's Well—23 feet deep; *Mr. Searl's Well*—24 feet deep. These two wells lie equidistant from Mr. Grant's, near St. Peter's Church, and from the well No. 3, class second. They were examined by the late Mr. Bowdich in October, 1822.

The depth of the wells was ascertained by actual measurement; as, also, the depth of water contained in each, at the time of observation.

The distance from the sea, and the height above its surface, are to be considered, as only approximations to the truth, no actual measurement having been made, at the time; but the data are furnished by two gentlemen, residents in Funchal, who are well acquainted with the localities of each, and whose judgment may be relied upon pretty confidently.

The temperatures were ascertained by one of Cary's register thermometers; and two or three trials were always made, each time the temperature was taken, in order to insure correctness, and justify the conclusion, that the index had not been removed in withdrawing the instrument from the bottom.

I shall first state the experiments which were made by Mr. Bowdich—as I only examined Mr. Young's and Mr. Searl's, once—and shall, then, give the temperature of the different springs which I, myself, examined. The other wells having been examined at different periods, the details relative to *them* will be better seen in the record of the respective months when their temperature was ascertained.

Observations made by Mr. Bowdich, in October, 1822, in the wells of Mr. Lundie, Mr. Young, and Mr. Searl, all above 20 feet deep; temperature of the air, 69°, ditto, bottom of wells, 58°.

Mr. Bowdich observes that this difference of temperature is explained by the fact, that those wells are supplied by streams which descend from heights of 3,800 feet, behind the town; whence there would follow a corresponding difference in the mean temperature. Temperature of air, 62°.

Spring near Mount Church, enclosed by Consul Murray, situate 1,900 feet above the wells, 58°.

I examined the wells of Mr. Young and Mr. Searl, along with my friend, Mr. Eaton, on the 14th of April, 1835.

Mr. Young's Well. Depth, 24 feet; depth of water, 8 feet; temperature, 6 inches beneath the surface, 63°; temperature of the bottom, $62\frac{1}{2}$°; mean temperature of April, 65°.39.

Mr. Searl's Well. Depth, 24 feet; depth of water, 12 feet; temperature, 6 inches beneath the surface, 65°; temperature of the bottom, 59°.

These observations would indicate that the temperature of the wells varies at different periods of the year, a circumstance which would entitle them to be placed in the fourth class, being situated—with the exception of Mr. Montero's—between the same rivers, as class second, but on higher ground.

EXAMINATION OF SPRINGS AT CAMPANARIO, SITUATE ABOUT NINE MILES WEST OF FUNCHAL, IN SEPTEMBER, 1835.

September 3.—Temperature of a spring about 2,500 feet above the sea, 11 a m., 62°. Tempera-

ture of air, in the shade, 69°; thermometer placed in the crevice of a rock, in the shade, indicated a temperature of 66°; temperature at Mr. Jervis's house, 500 feet lower than the spring, at 10 a.m., was 73°; at noon, 74°.

September 5.—Temperature of a spring at the level tract above Campanario, about 3,000 feet above the sea. Noon temperature of spring, 58°; temperature of air, in the large hollow chesnut tree, 65°; temperature of air at the Curral, 4,000 feet above the sea, at 3 p.m., 62°.

The air was saturated with humidity, the sun being much obscured, and the clouds passing rapidly over. This makes the temperature of the air at the *Achada*—a level tract—4° lower than at Campanario, and 11° lower than at Sta. Luzia—that of the Curral being 14° lower than the latter.

OBSERVATIONS ON THE TEMPERATURE OF THE SPRINGS IN THE N. AND N.E. OF THE ISLAND.

October 2.—Porta Cruz. Temperature of water, coming from the heights above, 64°—place of observation being about 400 feet above the sea.

October 3.—Fayal. Temperature of water about 400 feet above the sea, 65°; temperature of water half-way up the mountain, 60°.

October 4.—Temperature of a spring at St. Antonio da Serra, situate about 2,000 feet above the sea, examined 3 p.m., 62°; temperature of air—

thermometer, placed in the crevice of a rock in the shade—65°.

October 5.—The same spring, examined about noon, gave a temperature of 60°. There appeared to be much more water in the spring than on the preceding day.

October 30.—Temperature of two springs situated in Mr. Phelps's *Quinta*—country house—at the mount, near 2,000 feet above the sea, S. of the Island, 60°. These observations I was kindly favoured with by Mr. Phelps. They were taken at 6 a.m. The temperature at Sta. Luzia in the shade, at the same hour, was 64°.

TEMPERATURE OF THE WELLS.

FIRST CLASS.

No. 1.—April 3rd, 1835. *San Lazaro.* Depth 14 feet; depth of water, 4 feet; temperature of water, 6 inches beneath the surface, 62°; temperature of water at the bottom, 60°; mean temperature of April, 65°.39.

No. 2.—*Limekiln Well.* Depth, 28 feet; depth of water, 4 feet; temperature, 6 inches beneath the surface, 62°; temperature of bottom, 62°.

SECOND CLASS.

No. 1.—August 29, 1834. *Mr. Blackburn's Well.* 18 feet deep; depth of water, 2 feet; temperature

of the bottom, 67°; examined 9 a.m. This well is situated in a stable, thoroughly exposed.

No. 2.—*Mr. Ellicot's.* Depth of well, 22 feet; depth of water, about 6 inches; temperature of the bottom, 67°. This well is situated in a room, is covered by a stone, and supplies a pump.

No. 3.—*Mr. Grant's.* Depth of well, 12 feet; depth of water, 5 feet; temperature, 6 inches beneath the surface, 67°; temperature of the bottom, 67°. This well is situated in a cellar, thoroughly exposed. The above observations were made after there had been a continuance of twelve weeks' fair weather. Mean temperature of August, 72°.78.

October 29.—The rains up to this period had not been heavy. Mr. Grant's well examined 11 a.m. Depth of water, 5 feet; temperature, 6 inches beneath the surface, 68°; temperature of the bottom, 67°. 3 p.m.—temperature, 6 inches beneath the surface, 68°; temperature of the bottom, 67°. Mean temperature of October, 69°.49.

December 9.—Examined at 1 p.m. Depth of water, 8 feet; temperature, 6 inches beneath the surface, 67°; temperature of the bottom, 67°.

December 19.—Depth of water, 8 feet; temperature of the bottom, 67°. Mean temperature of December, 64°.25.

April 4th, 1835.—Examined at noon. Depth of water, 6 feet; temperature, 6 inches beneath the surface, 66°; temperature of the bottom, 66°.

No. 4.—October 30th. *Mr. Phelps's Well.* Depth, 21 feet; 10 a.m., depth of water, 8 feet; tempera-

ture, 6 inches beneath the surface, 68°; temperature of the bottom, 67°.

December 19.—Depth of water, 13 feet 6 inches; temperature of the bottom, 67°.

April 7, 1835.—Depth of water, 15 feet; temperature, 6 inches beneath the surface, 66°; temperature of the bottom, 66°.

THIRD CLASS.

No. 1.—October 30, 1834. *Blacksmith's-shop Well.* Depth, 20 feet; depth of water, 8 feet. 11 a.m.—temperature, 6 inches beneath the surface, 64°; temperature of the bottom, 62°. Mean temperature of October, 69°.49.

December 15.—1 p.m. Depth of water not ascertained; temperature, 6 inches beneath the surface, 64°: temperature of the bottom, 61°. Mean temperature of December, 64°.25.

March 13, 1835.—Examined along with Mr. Blewitt. Depth of water, 12 feet; temperature, 6 inches beneath the surface, 59°; temperature of the bottom, 57°. Mean temperature of March, 63°.43.

No 2.—October 30. *Mr. Alexander Cunha's Well*—Brandy Distillery. Depth of well, 24 feet. Noon—depth of water, 8 feet; temperature, 6 inches beneath the surface, 65°; temperature of the bottom, 62°.

March 16, 1835.—Examined along with Mr. Blewitt. Depth of water, 12 feet; temperature, 6

inches beneath the surface, 60°; temperature of the bottom, 57°.

No. 3.—October 30, 1834. *Mr. Cairns's Well.* Depth, 24 feet; depth of water, 9 feet; temperature, 6 inches beneath the surface, 65°; temperature of the bottom, $62\frac{1}{2}$°.

December 13.—Depth of water, 14 feet. Noon; temperature, 6 inches beneath the surface, 65°; temperature of the bottom, $63\frac{1}{2}$°.

March 18, 1835.—Examined along with Mr. Blewitt. Depth of water, 12 feet; temperature, 6 inches beneath the surface, 60°; temperature of the bottom, 59°.

Nos. 4 & 5.—*Mrs. Mair's Well.*—Examined October 30. Upper well; depth, 28 feet—open; depth of water, 7 feet 9 inches. 1 p.m.—temperature, 6 inches beneath the surface, 64°; temperature of the bottom, 64°. Lower well; depth, 18 feet—pump; depth of water, 9 feet; temperature, 6 inches beneath the surface, 65°; temperature of the bottom, $63\frac{1}{2}$°.

March 13, 1835.—Examined along with Mr. Blewitt. Upper well; depth of water, 12 feet; temperature, 6 inches beneath the surface, 62°; temperature of the bottom, 60°. Lower well; depth of water, 6 feet; temperature, 6 inches beneath the surface, 60°; temperature of the bottom, $59\frac{1}{2}$°.

April 15.—Upper well—14 feet water. 11 a.m. —temperature, 6 inches beneath the surface, 59°; temperature of the bottom, 59°.

No. 6.—*Mr. Francisco's Well*, opposite Mrs. Mair's. Depth of water, 10 feet; temperature, 6 inches beneath the surface, 59°; temperature of the bottom 59°.

No. 7.—April 7, 1835.—*Public Well.*—Examined along with Mr. Blewitt. Depth, 21 feet; depth of water. 9 feet; temperature, 6 inches beneath the surface, 59°; temperature of the bottom, 58°.

No. 8.—April 15.—*Mrs. Rosa's Well.* Depth, 30 feet; depth of water, 12 feet; temperature, 6 inches beneath the surface, 58°; temperature of the bottom, 57°.

No. 9.—*Mr. Miguel Carvalho's Well.* Depth, 30 feet; depth of water, 6 feet; temperature, 6 inches beneath the surface, 60°; temperature of the bottom, 59°.

FOURTH CLASS.

No. 1.—August 29, 1834.—*Mr. Grant's Well,*—near St. Peter's Church. Depth of well, 25 feet, and exposed to the air; depth of water, 9 feet; temperature, 6 inches beneath the surface, 70°; temperature of the bottom, 69°.

October 29.—Depth of water, 15 feet; temperature, 6 inches beneath the surface, 66°; temperature of the bottom, $65\frac{3}{4}$°.

December 9.—Depth of water, 25 feet, being full to the surface; temperature, 6 inches beneath the surface, 61°; temperature of the bottom, 60°.

December 13.—Depth of water, 10 feet; temperature of the bottom, 60°.

December 19.—Depth of water, 15 feet; tem perature of bottom, $57\frac{1}{4}$°.

April 7, 1835.—Depth of water, 15 feet; temperature, 6 inches beneath the surface, 60°; temperature of the bottom, 57°.

No. 2.—*Mr. Grant's Well*,—New Stores,—near St. Peter's Church. Depth of well, 32 feet; the deepest I have examined which contained water. The water in this well is not used.

December 19, 1834.—Depth of water, 3 feet; temperature of the bottom, 65°.

April 7, 1835.—Depth of water, 9 feet; temperature, 6 inches beneath the surface, 60°; temperature of the bottom, 59°.

No. 3.—*Mr. Montero's Well*, above the Pontinha. This well is 114 feet deep, and does not contain any water; it is freely exposed to the air.

March 18.—Two observations were made at 5 p.m., which gave a temperature of 64° each experiment.

If any of those wells were regarded, as affording any indication of the mean annual temperature, I should give this the preference; but as it was only examined once, it ought not to be depended upon, without further observations at different periods of the year. The mean temperature of March was 63°.43.

Temperature of the sea, examined along with my friends, Mr. Eaton, Mr. Blewitt, and Mr. Fraser.

March 13, 1835, 2 p.m.—Depth, 1 fathom; temperature, 63½°.

March 16, 1 p.m.—Depth, 2 fathoms; temperature, 63½°; temperature at 58 fathoms, 1½ miles from land, 62½°. 3 p.m., 2 miles from the shore; temperature of the sea, at 107 fathoms, 62°. Mean temperature of March, 63°.43.

RESULTS.

			NUMBER OF OBSERVATIONS.
FIRST CLASS....	Mean of top	62°.000	2
	Mean of bottom	61°.000	2
SECOND CLASS.	Mean of top	67°.142	8
	Mean of bottom	66°.818	11
THIRD CLASS...	Mean of top	61°.647	17
	Mean of bottom	60°.176	17
FOURTH CLASS.	Mean of top	63°.400	5
	Mean of bottom	61°.142	8
	Total		70

CHAPTER IX.

ON THE ISLAND OF SAINT MICHAEL'S. PONTA DELGADA, THE CAPITAL; BEING SITUATE IN 37° 45′ 10″. NORTH LATITUDE, AND 25°.36 WEST LONGITUDE, FROM LONDON.

On our way to England we touched at Saint Michael's, one of the Western Islands, where we remained ten days; during which time I had an opportunity of seeing a great part of the Island, and of comparing it with the able work of Dr. Webster; which I can confidently recommend, as giving a very good description of the Island generally.

The analysis of the mineral waters of the boiling springs, by Professor Dana, differs very much from the one given by Professor Faraday, a copy of which was kindly given to me by Mr. Reid, the British Consul. I brought specimens of the waters from the various springs, and an analysis will be offered to the public when completed.

Accompanied by my friend, Mr. Eaton, I ascertained the temperature of the principal springs, both hot and cold, situated, in the valley of the Furnas.

This varied from 60° to 212° Fahrenheit. The springs at the lake were all from 200° to 206°. They appear to abound in sulphur and sulphuretted hydrogen, and afford a copious deposit of iron; which the hot springs, in the valley of the Furnas, appear to be without.

The temperature of the springs at Ribeiro Grande was from 75° to 207°.

Dr. Webster observes that, "these waters are exceedingly beneficial in many diseases, and that, during the summer months, the valley of the Furnas is the resort of all classes of persons on the Island; who indulge to excess in the warm baths, remaining in them more than an hour daily for weeks. No debilitating effects follow, but, on the contrary, the whole system is invigorated, accompanied with a corresponding exhiliration of the spirits."

During my short stay in the valley I took one or two baths daily, and felt much benefit from them. Indeed, they are so soft and agreeable as, to induce the person who has once made trial of them, to continue their use, not only for the removal of disease, but as a luxury.

At present, they appear to be quite neglected by the public, and as it were almost unknown, even by name, in this country. "When the waters of the cold springs are drunk," observes Dr. Webster, "they prove both laxative and diuretic, and also promote excretion from the surface." To sum up, briefly, their general utility, he states that, "from

the general effects of the hot waters, and the decidedly tonic properties of the cold, they appear to be peculiarly adapted to all the formidable diseases originating in general debility and a disordered state of the digestive organs."

I may be allowed to quote Dr. Webster's work, with regard to a few passages, which, I think, objectionable, as tending to mislead those who may seek Saint Michael's for the benefit of health; especially as the first is corrected by Dr. Webster himself, in another part of his work, when speaking of Saint Michael's, as a residence for pulmonary invalids.

"Glass windows have been used only within a few years, and they are even at this day comparatively rare. The only protection in the greater number of houses against rain and cold are wooden shutters in the inside, with a few holes, from one to two inches square, cut in each. The temperature of the air is such, that it is rarely necessary to close even these, and in many of the cottages of the poor they are wholly wanting. Fires are never required, except for cooking, and a fire-place or stove, in any other apartment than the kitchen, is unknown; the interior of Portuguese houses being too often as devoid of cleanliness and comfort, as the exterior is, of beauty and neatness."

This passage applies to the natives entirely, as during the winter it would be difficult even for persons in health, far more so for delicate invalids, to do without fires, and not feel considerable incon-

venience; for, although the temperature is not much lower than at Madeira, it would be necessary to guard against the humidity, which, from the information derived from the residents, appears to be very great in the winter months, during the prevalence of the S. and S.W. winds. Indeed, at Madeira, fires are a very great desideratum; for, although the range of temperature is small and equable, nevertheless, after a short residence, the system gets so inured to a constant and almost invariable temperature, that a sudden variation from 3° to 5° is much more felt than a far greater range would be in England; where the temperature is always unequal and liable to sudden and great variations.

With regard to the temperature of the Azores, Dr. Webster observes, that "none of these islands are subject to sudden or great variations of temperature, and the extremes of heat and cold are never felt in them. The thermometer rarely indicates a temperature below 50° of Fahrenheit's scale, or above 75°."

Now, I ascertained from the residents, that the north and north-east winds, which are accounted dry, prevail during the summer; while the south and south-west, which are humid, predominate during the winter. Dr. Webster states, that, "St. Michael's is not visited so frequently by storms, as some of the islands in the group; yet it is not wholly exempt from them. Severe gales of wind occasionally occur, accompanied by torrents of rain,

causing great changes among the mountains—washing away the loose masses of pumice, and leaving the rocks, in many places, entirely destitute of soil."

During my stay in the Island, there was a prevalence of the North-East wind, which I found to be much more cold and bracing than at Madeira; although, at the latter place, it is by no means entirely divested of its chief characteristics, as has been so frequently stated to the public. Dr. Leman, who, as well as many others with whom I was acquainted, was peculiarly affected by this wind in England, also suffered from it in Madeira; but not to the same extent. We may, therefore, conclude, that, in the latter, its peculiar qualities are only modified, but by no means entirely destroyed.

Lastly, I may state Dr. Webster's opinion of this Island, as a residence for consumptive patients:—"A residence in St. Michael's has often been recommended to consumptive patients; but, although the temperature is mild and equable, there is, not unfrequently, a considerable degree of dampness, which is productive of unpleasant effects. The houses being of stone, and without fire-places, the phthisical subject is unable to guard against those slight atmospheric changes, which, although almost *unnoticed* and *unfelt* by those in health, are, to him, sources of some of his most unpleasant and depressing sensations. The temperate and *uniformly dry atmosphere of Madeira* is, on many accounts, to be preferred by the invalid. Although the climate of

Saint Michael's cannot be safely recommended to consumptive persons, it is, nevertheless, *rare* to see this disease in a native; but in Madeira, as appears from the observations of Dr. Gourlay, *no disease is more common.*"

I quote this passage, particularly with reference to the last part of it, which shows the general prejudice as respects the dryness of the Madeira climate; but, from what has been stated, in the preceding part of this work, respecting the humidity of the Island, the public will not be so entirely led away by an impression, the erroneousness of which is incontrovertibly demonstrated by experiments.

From my own experience I should be inclined to corroborate Dr. Gourlay's opinion, that consumption and scrofula are frequent in Madeira; and also to add, that affections of the stomach and digestive organs are very general; being the principal cause of death with a majority of the inhabitants.

From what has been previously stated, respecting the salubrity of Madeira, a person might be led to believe that disease was scarcely known there; but I am afraid, that, were the subject thoroughly investigated—as it ought to be—few places would be found, where the system is more liable to general disorder, while, at the same time, I suspect that the average duration of life would turn out to be inferior to that of our own country.

Table XXX. contains the few observations I made on the humidity of Ponta Delgada, and, if compared with those which I made at Funchal, five days

previously, the mean dryness will be found to be in favour of Saint Michael's—the mean of eight days in May, from 9 a.m. to 9 p.m., at Funchal, being 4°.84, whereas, during the same number of days, at Ponta Delgada, the hygrometer gave a dryness of 5°.33, or .49 drier than Funchal.

Table XXXI. gives the humidity in the valley of the Furnas; where, from the immense quantity of vapour constantly given off from the boiling springs, and modifying the atmosphere in that peculiar locality; an artificial climate, may be said to be created.

These observations were made in a bedroom, whence it will be seen, that until suitable accommodation be made for invalids, and the rooms thoroughly dried by fires or stoves, the injury accruing from this cause, would counterbalance the benefit which might be derived from bathing, and drinking the waters, if, indeed, it did not exceed it. There is no such accommodation at present; but a house, intended for invalids, has just been commenced, and, as I have been given to understand, will be furnished with fire-places, boarded floors, hot and cold baths, &c.

During the middle of the day, I found it much drier out-doors, than in the room above-mentioned, but by no means so dry as at Ponta Delgada. The temperature in the valley of the Furnas, situate about 2,000 feet above the sea, was from 8° to 10° colder than in the city.

At present there is no accommodation in the

Island, at all suitable to an invalid; there is not one lodging-house; and the inns are by no means calculated for the purpose. Furnished houses are not to be procured; unfurnished ones are difficult to be met with; and, if found, would require to be almost rebuilt, in order to render them at all suitable for a delicate invalid; as they are destitute of fire-places, or of windows and doors, capable of preventing constant currents of air.

The form of the clouds, most general, was that of the cumulus, being at marked distances from each other. The clouds appeared lower and more dense, than at Madeira; the blue sky a few shades deeper; while the clear grey was of the same tint.

With regard to the vegetation as indicating a humid climate, the lichens, ferns, and other plants of this description, are much more abundant at Saint Michael's than at Madeira. Indeed, a great field is open, in this Island, for the study of this species of plants, many of the ferns being at least two yards in height.

For scenery, and cultivation, and for favouring pursuits in natural history, &c., St. Michael's is far more interesting than Madeira. Topographically, it is much better calculated for invalids, who require constant exercise in the open air; as many level roads may be found, suitable both for horse and foot exercise, in almost any part of the Island; and as, near the city, carriage exercise might be indulged in; but not without the risk of dust, the absence of which was one of the greatest comforts I experienced during my residence in Madeira.

Ponta Delgada is much better built than Funchal; and, notwithstanding the innumerable dogs, pigs, and donkeys, which constantly infest the streets, is, undoubtedly, cleaner and freer from loathsome odours than Funchal. Of course, I only speak of the period during which I visited the former city, being ignorant of its state in winter.

The inhabitants of St. Michael's are of a fairer complexion and appear more healthy, and are more cleanly about the person, than the inhabitants of Madeira. The cast of countenance is much more European.

As far as a short residence entitles a person to give an opinion, and relying on the authority of Dr. Webster's work, I should say, that St. Michael's has been quite as much under-rated, as a residence for invalids, as Madeira has been over-rated; and, if pecuniary matters be taken into account, both as regards the expense of living in the Island, and that of a sea voyage, it is to be preferred; the former being much more reasonable, while the latter does not amount to half the expense. The only desiderata are suitable accommodations; but, should the Island become better known, there can exist little doubt, that these would be provided, notwithstanding the apathy of the natives; who appear to be entirely divested of the *spirit-stirring* feeling of the English, when any opportunity offers of bettering their condition in a pecuniary point of view.

The Portuguese are contented to live at ease, provided they can procure a sufficiency of the common necessaries of life, without at all indulging

in the luxuries or the elegancies, peculiar to modern refinement—with the exception of those little quiet attentions to each other, manifestly of continental origin.

In this they contrast strongly with the English. Indeed, the Portuguese are entirely destitute of that kind of feeling which recognises those *comforts* of life, that we, from the nature of our own climate, deem absolutely essential to our existence; habits which, although natural in their origin, are yet found to be factitious, when separated from the causes which produced them.

PART II.

CLIMATE.

BY J. A. MASON, M.D.

PHYSIOLOGY.

CHAPTER X.

ATMOSPHERIC INFLUENCES ON RESPIRATION.

To form an estimate of the effects of climate, we have to consider—in addition to the usual and unvarying amount of gases, essentially constituting the atmosphere—the amount of aqueous vapour, the temperature, the electric state, the degree of pressure, the action of light, the permanent, as well as occasional, currents, the quantity of carbonic acid gas, and of other incidental emanations; besides the character of the soil, which contributes so much to modify all the preceding conditions.

The art, then, of suiting climate to an individual, consists in adapting those external circumstances to the peculiar condition of his organization.

The limits, within which persons of feeble organization can enjoy life, are more confined than those which are suitable for other persons: but the knowledge of these limits may serve to procure for them health, and even longevity.

The different conditions of the atmosphere ought to be considered, separately, and in combination; as they exert a very complicated effect on the animal economy.

I commence with the function of respiration, in regard only to the quantities of oxygen and nitrogen.

Although at every altitude, and under all circumstances, the oxygen and nitrogen always exist, in certain and unvarying proportions; yet it does not follow that, under all circumstances, the same quantities exist in a given space. This fact, which is of importance, has been overlooked, in examining the influence which the atmosphere exerts over the human system. The quantity of oxygen, in a given space, must vary, according to the density of the atmospheric air at the time of observation. Thus a portion of air at the temperature of 32° would undoubtedly contain more oxygen than an equal volume at 60° or 70°; and the quantity must constantly vary, in proportion as it is affected by the following causes, viz.:—

First—Expansion from temperature;

Second—Expansion from elevation;

Third—Expansion from aqueous vapour, existing in the atmosphere.

How will these conditions, separate or combined, determine the quantity of oxygen in a given portion of atmospheric air?

The greater the density, the larger will be the proportion of oxygen. Thus a dry air at 32°, and under a pressure of 30 inches, would contain more

oxygen, in a given space, than a similar portion at 62° under the same pressure and hygrometric condition.

How will this hold, with regard to the action of air in the process of respiration? Will a larger portion of oxygen be brought in contact with the lungs, in proportion to the specific gravity of the atmospheric air? This is a complicated question, and requires some consideration, before it can be satisfactorily solved.

What influence has temperature, alone, with regard to the quantity of oxygen, brought in contact with the lungs? Will more oxygen be afforded when a person inhales air at 32°, than at 62° under the same pressure and in the same hygrometric condition? Does a person inhale the same volume of air at 32° as he does at 62°? If, when in contact with the lungs, the air inspired be always nearly equal in temperature to that of the body; the difference of specific gravity, arising from temperature, will have no effect, as regards the quantity of oxygen in a given space; the temperature, and, consequently, the expansion, being always the same. If this be correct, a less portion of air ought to be inhaled at 32° than at 62°. If the *same* quantity be inhaled, what effect does the expansion produce with regard to the distention of the air cells; as further distention would take place at every temperature, lower than that of the body?

If this cause has no influence with regard to the quantity of oxygen inspired, it will, nevertheless,

exert a cooling effect, greater, in proportion as the temperature of the air is less than that of the body. Thus, although the body be provided with more suitable clothing, to guard against the effects of cold; no precaution can avert the great reduction of temperature which is constantly going on from the *lungs;* heat being absorbed to raise the temperature of the inspired air to that of the body.

In the healthy condition of the body are the respirations more frequent in winter than in summer, to compensate for the greater loss of caloric, by a greater supply of oxygen? or, does the hygrometric condition of the atmosphere make up for this deficiency?

Where, from disease or other causes, there exists an inability to generate a sufficient supply of animal heat, the determining of this question must be of considerable importance; for, in such a case, either the body must be reduced below the natural standard of health, or the temperature of the air, inspired, may not be raised to its ordinary condition; either of which circumstances may exercise a considerable influence on the function of respiration, as chemical action is so dependent upon the influence of temperature. This would be one cause for sending a patient, possessing such an organization, to a warm climate; that his animal heat might be maintained at the natural standard of healthy action.

Secondly—Does the pressure of the atmosphere affect the specific gravity of the air; and how,

thereby, is the animal economy influenced? It is universally admitted that, in a given space, there is a greater quantity of oxygen, at a pressure of 31, than at one of 28 inches; other conditions being equal. There is no condition of the *body* to counteract this influence; consequently, an individual will have presented to him a larger portion of oxygen in a given number of respirations, when the barometer is high, than when it indicates an inferior pressure. This will account for the langour and lassitude, experienced by many individuals in humid weather, when the barometer indicates a low degree of atmospheric pressure; the quantity of oxygen, inhaled, being less, than when the atmosphere is dry, and the pressure of the incumbent mass considerable. Besides, if a person is located many hundred feet above the sea, the air is expanded from that elevation; and, certainly, air at the same temperature at the level of the sea would contain a larger portion of oxygen in a given space. This would militate against resorting to the climate of a mountainous country, such as Madeira, or against merely changing to a higher elevation, during the summer months, when the temperature becomes higher; instead of returning to a colder latitude. For, although, a higher situation would suit, as regards temperature; yet, in other respects, the body would not be under similar circumstances; unless it could be proved that the less humid condition of the air, at a low temperature, compensates for the increased expansion at an elevated

locality; and that the oxygen will be afforded in the same proportion, as under a higher atmospheric pressure.

Thirdly—What influence does the vapour contained in the atmosphere exert over its expansion at different temperatures, and in different hygrometric conditions?

The expansion produced by vapour will diminish the quantity of oxygen, existing in a given space, in proportion to the temperature, supposing the air to be fully saturated; and if not fully saturated, in proportion to the actual quantity of vapour, existing. Thus, dry air will contain more oxygen in a given space than air, almost, or altogether, saturated with vapour.

But will this variable physical condition of the atmosphere exert any influence on the respiratory functions? Is it counteracted by the nature of the organization; or, in other words, does dry air, when inspired, afford more oxygen, in a given volume, than air, fully saturated? From physiological facts we should decide in the negative; for, supposing the air fully saturated in the lungs, neither expansion from temperature or vapour, can exert any influence, as regards the quantity of oxygen in a given space; both being invariably expanded to the same degree, viz., 95° temperature.

Thus, as regards the quantity of oxygen in a given space, its relation to the function of respiration can only be increased or diminished, according to the greater or less pressure of the atmospheric

column. For temperature and humidity are rendered neutral by a specific relation to the organization; as there exists a property in the body of always regulating the quantity of oxygen in a given space, so that it shall be constantly afforded in the same quantity, at the same temperature, and under the same force of elasticity of the aqueous vapour, existing. These conditions, acting simultaneously, may be necessary to the due performance of arterialization in the perfect condition of the body.

If, from unusual bodily exertion, a further supply of oxygen be necessary, the compensation will be made by either deeper or more frequent inspirations. This is in exact accordance with the harmony of nature. For, when we consider the vast influence which the oxygen of the atmosphere exerts, either directly or indirectly, over every function of the economy, it would not have consisted with that *all-skilful* workmanship, which is manifest throughout creation, that its Divine Author should have framed an organization so constituted, that life itself would have been endangered by the ordinary changes of the atmosphere; as would have been the case had the quantity of oxygen, respired, depended upon the purely physical condition of the atmosphere, without any regulating vital property. Had such a regulating power been denied, the organization of the lungs must have been very different at the equator and at the poles, and man, in a state of health, could not possibly have availed himself

of that range of climate which he may now enjoy, not only with impunity, but even, and not unfrequently, with advantage.

In all our speculations we should recollect that the laws of nature, and the influence which they exert over the animal economy, were made in reference to, our organization, in its most perfect condition; and were designed to act in harmony with it. Hence it will be found that the various atmospheric changes produce little or no disturbance in a healthy state of the human system, which, then, easily adapts itself to those natural phenomena, and that it is only in cases of diseased structure that they operate injuriously, as there no longer exists that correspondence between the animal organization, and the accidents of a range of climate, which is necessary to insure a due performance of the animal functions.

In such a case we are bound to take advantage of a peculiar locality, with regard to those modifications of atmospheric temperature, humidity, dryness, &c., which, while they are the least likely to aggravate disease, afford a reasonable hope of a return to healthy action.

Let us now consider the hygrometric state of the atmosphere with regard to its action on the function of respiration; not as respects the quantity of oxygen in a given space, but as influencing pulmonary exhalation or evaporation.

Lavoisier and Sequin estimated the average loss by perspiration from the skin, and lungs, in twenty-

four hours, at 2 lbs. 13 oz.; of which 1 lb. 14 oz. are dissipated by the skin, and 15 oz. by the lungs; which gives the proportion of two to one. Can this exhalation from the lungs be perfectly arrested by any hygrometric condition of the air? How is it given off from the lungs? According to the experiments of Edwards, "Whatever transudation there may be within the lungs, no liquid can issue from them but in the form of vapour. A new portion of air enters at each inspiration, it becomes warm, and remains there until the whole mass rises nearly to the temperature of the body. By virtue of this acquired elevation, whatever may have been the previous hygrometric state, it converts into vapour the liquid with which it is in contact; and, in respiration, carries this vapour into the atmosphere; bringing with it no water in a liquid state, nor any other substance, in this form. There is, then, no loss by pulmonary transudation. All the perspiration, as far as water is concerned, takes place by evaporation, making a considerable difference between the lungs and the skin, where the two modes of perspiration are united."

As this is the case, much depends upon the hygrometric condition of the atmosphere; for the quantity exhaled from the lungs must bear a certain relation to the temperature of the air, inspired, and the quantity of humidity held in solution, or to the distance from perfect saturation. Cold air, although containing its full quantum of vapour, will produce the same effect with regard to the

quantity of water, given off from the lungs, as air, at a much higher temperature, even when excessively dry. Thus we shall find that the cold frosty air, in England, produces precisely the same effect, as the hot and parching *Leste* of Madeira. From its greater simplicity, the pulmonary perspiration is much more regular; and, consequently, the losses are much more nearly equal at different periods. However, the loss of water by the lungs is capable of being suppressed; because, being performed by a physical process, it may be stopped by the physical conditions which prevent evaporation. In an atmosphere, saturated with moisture, if the temperature were equal to, or above, that of the body, there would be no watery perspiration from the lungs, because there would be no evaporation; while the cutaneous perspiration would take place, not by evaporation, but by transudation; and that to a very large amount. An instance of this I witnessed in Madeira, where a man entered one of the *estufas* at a temperature of 160°, the air being saturated with water and spirituous vapour from the wine. Pulmonary exhalation was suppressed; and, after remaining three-and-a-half minutes, perspiration by transudation was excited to such an extent, that sweat streamed from every part of his body. The respiration was increased in frequency; and he appeared so exhausted, as to be scarcely able to stand. He continued panting, for eight or ten minutes, after he came in contact with the external atmosphere, which at the time was from 65° to 70°.

Hence, we see that a cold, though humid air, will produce the same effect, in removing pulmonary and cutaneous perspiration, as warm dry air; for the high temperature of man, and other warm-blooded animals, affects the air, in contact with the body, and changes its hygrometric state, by removing it from its extreme of humidity; and, consequently, occasions evaporation.

From this, we conclude, that warm humid air is more prejudicial to a sound organization; than any other atmospheric condition; for both pulmonary and cutaneous transpiration will be impeded; and this loss must be compensated by an increase of cutaneous transudation, which not only removes the watery part of the blood, but also takes, along with it, much animal matter; producing a debilitating effect on the system, generally, by requiring greater exertion of the reparative forces.

Let us apply these principles to the climates of London and Madeira.

It is clear from the above premises that supposing the hygrometric state of the air, in Madeira and London, to be the same—both equally removed from the point of full saturation—the pulmonary exhalation must be much more impeded in the former than in the latter; as in the former, the mean temperature is nearer to that of the lungs or the body—a temperature at which, supposing it to be saturated with moisture, pulmonary exhalation would be impossible. Thus, to compensate for the diminished pulmonary exhalation, more work

would be given to the skin, abdominal viscera, and other exhaling surfaces, the diseases of which organs are always most numerous in warm humid climates; and the same thing would take place in our own country, during the summer months, provided the weather were unusually damp.

To form a just estimate, let us suppose the air, at both places, to be fully saturated; and then let us see what difference the mean temperature will make in the hygrometric condition of the air, with regard to its effects in promoting or impeding this function of the lungs.

The mean temperature of Funchal, Madeira, is 66°, which would support if saturated 7.447 grains per cubic foot, of aqueous vapour. Air when in contact with the lungs, during inspiration, will have its temperature raised to 95°; which would support 17.009 grains of vapour, per cubic foot. If we subtract the quantity of aqueous vapour, which the temperature of 66° would support, viz., 7.447 grains, from the quantity which 95° will support, viz., 17.009 grains; the result will be, that for every cubic foot of air, respired, 9.562 grains of aqueous vapour would be removed from the system, by pulmonary exhalation. Now, it is estimated, that an individual, of moderate size, inhales 666 cubic feet of atmospheric air in twenty-four hours; which will give 6368.292 grains, or 14 oz. 8 drs. $25\frac{1}{2}$ grs. of aqueous vapour, exhaled from the lungs, in that space of time.

In London, the mean temperature, which is 50°

Fahrenheit, would support 4.535 grains. The temperature of the inspired air being the same as at Madeira, 95°, will give, as above, 17.009 grains. Now, if 4.535 grains be subtracted from 17.009 grains, the remainder will be 12.474 grains, removed from the system, for every cubic foot of air respired; if this be multiplied by 666, the result will be 8307.684 grains, or 18 oz. 15 drs. 23½ grs. for the twenty-four hours.

From this, it will be seen, that, in Madeira, there are 4 oz. 6 drs. 25 grs. less, of aqueous vapour, exhaled from the lungs every twenty-four hours, than in London.

This excess must be given off from the skin, either by insensible perspiration, or by transudation; and, as evaporation from the skin is a physical process, it will be impeded or increased by the same causes, as those which influence pulmonary exhalation. Indeed, it is estimated that air, of a moderate dryness, may render the losses, by insensible perspiration, six or seven times greater, than what occur in cases of increased humidity, and may even go much further. This being the case, the compensation, in the latter event, must be made by transudation or sweat; which is a vital action, and goes on, independent of the physical causes, which control the former. As a proof of this, we find that, after any exertion, the inhabitants of Madeira are bathed in perspiration; and, if the exercise has been severe, we frequently see it flow from their clothing, almost in a stream.

Even when at rest, at the close of the evening, as the increased humidity comes on, we see the sweat, standing on the foreheads of very many individuals; and almost all complain of the heat, although it may be from 3° to 5° less than in the middle of the day; when the air, being further removed from the point of saturation, we observed neither of these conditions, although the temperature is higher. By the dewpoint, the process of simple calculation will enable us to ascertain the weight of aqueous vapour, that can be exhaled from the lungs, in any climate.

By Table XXVIII. we see that the mean humidity of the climate of London is only 0.978 of a grain, removed from full saturation. If we call this one grain, to facilitate calculation, and multiply it by 666, the number of cubic feet respired in twenty-four hours, the result would give 1 oz. 8 drs. 9¾ grs.; which, added to 18 oz. 15 drs. 23 grs., the quantity that would be given off, supposing the mean temperature to be saturated, will make 20 oz. 8 drs. 6¼ grs.—the actual quantity eliminated from the lungs in twenty-four hours.

By Table XXVII. we see that the mean humidity of the climate of Funchal is 1°.620 removed from full saturation. This, as I have shown, is too high; but, to be on the safe side, we shall place it still higher, namely, at 2 grains, which, multiplied by 666, will make 3 oz. 0 drs. 19½ grs. This, being added to 14 oz. 8 drs. 25½ grs., the quantity given off, supposing the mean tempera-

ture saturated, will amount to 17 oz. 9 drs. 18 grs. as the quantity exhaled from the lungs in twenty-four hours. This will give 2 oz. 14 drs. $15\frac{3}{4}$ grs. less, every twenty-four hours, at Madeira, than would be given off by pulmonary exhalation in London. From these calculations, we perceive that the average estimate of Lavoisier and Sequin is too low; unless the experiments were performed either at a very high temperature, or when the air was excessively humid. The quantity must vary with every degree of temperature, and every increase or decrease of humidity. The dewpoint for different countries, and for various localities of the same country, being once ascertained, it would be easy to calculate tables, presenting the quantity given off at every temperature, and under every degree of humidity to which the body might be exposed. Such tables would be of incalculable value, in a practical point of view; as they would enable us to place a patient under the most favourable circumstances for recovery.

A similar difference, as regards the quantity of vapour, given off by pulmonary exhalation, will take place between the summer and winter months of our own country.

According to Professor Daniel, the mean temperature of winter in London is $37^{\circ}.7$, a temperature which would support 3.040 grains of vapour, in each cubic foot of atmospheric air; while the dewpoint being $35^{\circ}.6$, we find by calculation that there actually exist only 2.943 grains; which, sub-

tracted from 17.009 grains—the temperature of the air in contact with the lungs—gives 14.066 grains of aqueous vapour, given off, for every cubic foot of air respired; thus amounting to 21 oz. 6 drs. 17½ grs. in twenty-four hours.

In summer the mean temperature is 60°.4 which would support 6.299 grains. The dewpoint being 35°.5, will reduce the vapour, actually existing in the atmosphere, to 5.026 grains; which subtracted from 17.009, will give 11.983 grains, or 18 oz., 3 drs., 24¾ grs. for the twenty-four hours. Thus in the summer months we have a decrease of pulmonary evaporation, amounting to 2.083 grains, per cubic foot—equal to 3 oz., 2 drs., 19¾ grs. in the twenty-four hours. From this it will appear, that there exists the same difference, between our winter and summer months, as between the mean average of London and Madeira; and hence we may calculate the influence of climate; and ascertain whether the most dangerous results may not take place when patients are unadvisedly sent to such a locality as the latter.

In our own country we may see what dangers a sudden change produces in individuals of a weak constitution; where the skin, and other exhalary surfaces, cannot adapt themselves, so as to compensate for the variations of the atmosphere.

With regard to individuals who labour under certain diseases, which would be aggravated by a considerable evaporation from the surface of the lungs or skin; we see the propriety of a change to

a warm and humid climate, like Madeira, where pulmonary evaporation would be impeded; as such individuals always suffer from the cold of our winter, which, in their cases, produces the same effect as excessively dry air. It is proved that large quantities of fluid, received into the stomach, will not remedy the effects of that rapid exhalation from the lungs, which is produced by air, either cold, or excessively dry. Thus, of necessity, a mild humid air will place the patient under those circumstances which are the most favourable to his recovery. If this cannot be done by change of climate, the evil ought to be obviated, as far as possible, by resorting to artificial means. The atmosphere in the immediate vicinity of the patient ought to be rendered humid, by maintaining a sufficient evaporation from water; whereby, the air being rendered moist, the too rapid desiccation of the respiratory organs, will be, not only modified, but arrested, in consequence of vaporous absorption. It will be also necessary to place the patient in a temperate atmosphere; for, if that condition be neglected, it is obvious that, although the air be saturated, nevertheless, if it be cold, it will not produce the desired effect; as, with regard to pulmonary exhalation, it will operate in precisely the same manner as dry air.

On the contrary, if the conditions of the system are the reverse, that is, if a free and copious evaporation from the skin and lungs be beneficial; by placing the patient in a humid atmosphere, or by

sending him to a climate similar to that of Madeira, you will consult the most unfavourable condition for his recovery. This we shall find to be the case if we attend to the feverish sensations, which the *Leste*—a dry, warm wind—produces at Madeira, in patients of the latter description; while those of the former class, or persons in perfect health, experience the greatest oppression and annoyance. The first description of such patients ought to be placed in a warm dry air; or, even, in one that is cold, yet dry; as the same beneficial effect will be produced, provided the system be capable of generating a good supply of animal heat. In the latter case, the patient will frequently find himself much better in the evening, when confined in a close room, than he did in the middle of the day; as the air being heated, on entering the room, it is, also, rendered much drier, which accounts for the relief thus produced.

The condition of the atmosphere during a *Leste*, may be calculated from data, obtained by the late Dr. Heineken, with Daniel's hygrometer; when the dewpoint was 45° below the temperature of the air, yet, nevertheless, did not produce precipitation; so that the maximum state of dryness was not ascertained.

The temperature of the air, in the shade, was 85°, which would support 13.081 grains of vapour, per cubic foot; and the dewpoint, being 40°, will give 2.965, actually existing; which, subtracted from 17.099, will give 14.044 grains per cubic foot,

exhaled from the lungs, or 21 oz. 6 drs. 3 grs. in twenty-four hours; amounting to 3 oz. 12 drs. 12 grs. more than is evaporated from the lungs, in the ordinary condition of the atmosphere in Madeira. And, if we take into account the increase of insensible perspiration by the skin—which, as has been proved, is seven or eight times greater in moderately dry, than in humid air—we may imagine the quantity given off under those favourable circumstances; and thence ascertain the degree of evil or benefit which is likely to arise from such a state of the atmosphere, accordingly as the constitution is adapted, or not, to act in harmony with such conditions. Thus, it appears, that the difference, as regards the quantity of aqueous vapour, evolved from the lungs, in Madeira, during a *Leste*, and under the ordinary conditions of the atmosphere; is greater than what takes place in the mean of our own winter and summer months; and that, notwithstanding the excessive dryness of the *Leste*, the quantity given off, during its continuance, exceeds, by the proportion of 14½ grains, in the course of twenty-four hours, what is eliminated, in the same space of time, in our own ordinary winter.

From this statement we can account for the fact, that patients who visit Madeira are so differently affected by the precisely same conditions of the atmosphere; some experiencing relief, and others, only an aggravation, of their complaint. Accordingly, the present work will be regarded not as an

attempt to prejudice that Island as a resort for invalids, but as an effort to point out the danger of an *indiscriminate* reliance upon the sanatory effects of its climate. Such a reliance is injurious. The not unfrequently frustrated hopes of anxious friends, suggest advantages, real or imaginary, from a resort to other localities ; whereas the atmospheric phenomena of Madeira being ascertained, and the requirements of the patient, found to correspond therewith, comparative uniformity of success would establish its reputation ; and the failure of cases, to which its climate is not adapted, would not be attended with the effect of damaging its character, as a residence for those who, by a change to such a locality, might reasonably calculate upon the realization of their most sanguine expectations.

CHAPTER XI.

INFLUENCE OF THE HYGROMETRIC STATE OF THE ATMOSPHERE ON THE FUNCTIONS OF THE SKIN.

Before making further remarks on the influence which the dry wind produces upon the animal economy; it will be necessary to consider, briefly, what influence the hygrometric condition of the atmosphere exerts on the functions of the skin, in promoting or impeding sensible and insensible perspiration.

In the first place, we must consider the nature of this excretion. According to Edwards, "perspiration is of two kinds—sensible, and insensible; the former acting by transudation, or sweat; the latter, by evaporation. All that is lost by insensible perspiration, ought to be considered as the result of perspiring by evaporation—a process which takes place in the dead, as well as the living, body. This is a consequence of that porosity of organized bodies, by which the liquids, near surfaces in contact with the air, diminish in quantity by being converted into vapour, even though the pores should be such

as not to give passage to a single drop of liquid." This is a physical process, and is influenced by the physical conditions of the atmosphere.

There are three conditions which regulate this process—viz., the hygrometric state, the motion, and the pressure of the atmosphere; the dryness, the agitation, and the rarifaction of which increase evaporation. These causes do not produce sweat, because they act in a physical manner; as they diminish the mass of liquids, by causing a part to be converted into vapour. Sweat, on the contrary, is a loss, produced by a vital action, in the form of a liquid which transudes; and is uninfluenced by those causes which increase or impede insensible perspiration. Dr. Edwards asks: "Is not the skin an excretory organ, capable of eliminating, from the body, a certain quantity of liquid, independently of the co-operation of external agents; in like manner as the urinary organs separate and reject a part of the materials of the blood?" And goes on to observe, that "all that the skin loses, in virtue of this power, is by transudation; and ought to be regarded as a vital function. The quantity of liquid which issues in this way, may be so small; or, if abundant, may be so rapidly dissipated, in vapour, as to be insensible, or not perceptible in the form of sweat; but the difference is this, that transudation takes place, before evaporation commences; and that, when it becomes sensible, it must also exert a cooling influence on the body. It is further distinguished by containing salts, in

solution, and a small quantity of animal matter; whereas insensible perspiration is nothing but pure aqueous vapour. It is also necessary to remark, that, under peculiar circumstances, the vapour of insensible perspiration may be condensed and precipitated upon the skin, in the form of a liquid."

In the ordinary condition of the body, perspiration, by evaporation, is six times greater than perspiration by transudation. When we reflect upon those two distinct processes we cannot sufficiently admire the skill of our Creator.

From experiments it is proved that 2 lbs. 13 oz. of liquid must be removed from the system by the skin and lungs, every twenty-four hours, in order that the body may be maintained in its healthy condition. Supposing that this process depended altogether upon the physical condition of the atmosphere, as regards temperature and its hygrometric state—which is the case with the lungs,—and upon perspiration by evaporation from the skin; life would have been endangered by every unusual condition of the atmosphere; for, if fully saturated with humidity, this process would be so much impeded, that healthy action could not long continue; the constitution of the organization not being in harmony with the surrounding medium in which it was destined to exist. Transudation, then, must be regarded as the regulator of this excretion; its chief office being to compensate for the non-fulfilment of perspiration by evaporation from the skin and lungs; consequently, when this is impeded or

altogether prevented by the physical condition of the atmosphere, it will take place in proportion as the other process becomes diminished. In the natural healthy condition of the organization it seems exclusively to exist; and, being a vital process, is ever ready to perform its function, when the wants of the system demand its interference.

Thus we see how admirably this process harmonizes with the condition of the surrounding medium; and may learn how careful nature is in providing for any process, which, for its fulfilment, may depend alone on physical causes. At the same time we should take care, that, whenever an act can be performed by the influence which a purely physical condition exerts over the organization; a saving may be made in a vital process, which suffers deterioration from protracted continuance; or gradually impoverishes the system, by the expenditure of the forces usually termed vital. Were not this the case there is no reason why our organization should not last for ever, when we contemplate its admirable adaptation to the whole external creation by which we are surrounded; but we are so constituted, as continually, though almost imperceptibly, to suffer gradual deterioration; by which our organization becomes, at length, so much exhausted that it is no longer able to support those functions, that are termed vital; and yielding, at last, to the common laws of matter, life becomes extinct; and our bodies are reduced to their primitive elements.

We have now seen that sweat or transudation is a vital process, and cannot be prevented by any physical condition of the atmosphere, which would entirely suppress insensible perspiration. Its action may be modified by the influence which temperature exerts upon the living tissues. Cold will diminish this secretion; but, in the healthy condition of the body, it will be compensated by insensible perspiration, which is increased by every cause that tends to diminish the other. Thus, whatever has a tendency to supply the one, increases the other, and *vice versa;* so that perspiration, sensible or insensible, cannot be suppressed; for, if cold prevented transudation *altogether*, it would by no means diminish perspiration by evaporation, which will always take place at temperatures inferior to that of the body, however humid the air may be; and that in proportion to the coldness of the atmosphere. The high temperature of all warm-blooded animals warms the air in contact with the body, and changes its hygrometric condition by removing it from its extreme of humidity; and this in exact proportion to the heat given out by the animal. If, from any unhealthy condition, the animal cannot supply sufficient heat when exposed to a low temperature; insensible perspiration will then be diminished, and both transudation and perspiration by vapour will be impeded; whence the organization will suffer in proportion to its inability to generate heat. If, on the contrary, the air, being saturated with humidity, be raised to an equality

with that of the body, perspiration, by evaporation, both from the skin and lungs, will be entirely prevented; and perspiration by transudation will be excited to such a degree, as will compensate for the cessation of the former, as respects the skin and lungs. The sweat will stream from all parts of the body, an instance of which was given in the case of men, attending the *estufas* in Madeira. With regard to temperature, Dr. Edwards has proved that, at from 38° to 68° of Fahrenheit, it exerts very little effect in increasing transudation. At a temperature of 78° it commences; and is evident on many persons, even in a state of rest, provided the air be not too dry or too agitated. Once commenced, this secretion takes place more rapidly than the increase of temperature would lead us to expect, provided the air be at the same time humid. The reason of this is obvious, as perspiration by evaporation, both from the lungs and skin, must be diminished in exact proportion as the temperature of the air approaches that of the body; and, consequently, transudation having to supply the place of both, it must rapidly increase, or the secretion from the system would diminish in quantity. There will, therefore, be a degree at which the loss by transudation may equal that resulting from perspiration by evaporation in a very dry air at or below 68° Fahrenheit. At a temperature of 104° the excretion is greater than under ordinary circumstances, in the proportion of 55 to 1.

We must also recollect that when sweat inter-

cepts the contact of air with the skin, there is no perspiration by evaporation, or insensible perspiration properly so called. There is evaporation, at the expense of the layer of sweat, always supplied by transudation, and in proportion to the dryness, and low pressure of the atmosphere; but no fluid evaporates from within; and, so far, there is no insensible perspiration. Evaporation will take place, and remove a portion of the *transuded fluid*—in the same manner as it would act upon the surface of a liquid, in any other situation—in proportion to the temperature, low pressure, and dryness of the atmosphere. The effect, in reducing the temperature of the body, we shall afterwards see.

The weight or density of the atmosphere exerts an influence upon perspiration, by evaporation; as diminution of pressure upon liquids, accelerates their conversion into vapour. Hence perspiration will be more free, when the pressure, or density, of the air is least.

With regard to the agitation of the atmosphere, Dr. Edwards proved that the motion of the air uniformly tends to increase insensible perspiration. He observes, "This cause is so powerful, that differences in the motion of the air, which appear very slight, and which are sometimes imperceptible, occasion very great differences in the losses from perspiration; so much do the physical conditions, under which evaporation takes place, influence the results of this function." It is necessary, here, to recollect that the motion of the air can only increase insen-

sible perspiration from the skin; that it cannot have the least influence upon that of the lungs; and that this effect is applicable only to those circumstances, in which there is not a marked tendency to sensible perspiration or sweat:—in which case it will not increase the excretion, but only remove a larger quantity of the fluid already transuded; and produce a considerable reduction of temperature, in proportion to the rapidity and dryness of the air. The fact, then, is, that, with regard to its effects upon the skin, the agitation of the air, provided it is not at the point of extreme saturation, may increase the insensible perspiration; or tend to remove the liquid, already transuded, as efficiently as a drier air at rest. The reason is this—the atmosphere, in immediate contact with the body, is not only warm but humid; and that, which replaces it, is not only colder, but, at the same time, drier.

Lastly, we may make a few observations respecting the hygrometric condition of the air; and its effects in increasing or diminishing the temperature of the body. We lose heat in three ways—viz., by evaporation, by the contact of the air, and by radiation.

The motion of the air, whether it be dry or humid, considerably increases the quantity of heat, taken away by contact; and in a degree proportioned to the rapidity of the current. To this must be added the refrigeration, produced by an increased evaporation; which, also, augments with

the rapidity of the wind. This effect is so considerable, especially when the body is covered by sensible perspiration, that an individual becomes very rapidly chilled; and, provided this takes place at a low atmospheric temperature, where the heat, necessary to convert the liquid into vapour, is derived almost altogether from the body, it will not excite our surprise; when we call to mind the fact, that each grain of sweat, on being converted into vapour, removes heat, sufficient to raise one thousand grains of water, one degree.

In a dry air, less heat is taken off by contact—that is, the cooling power is less. Hence the heat will tend to accumulate on the body; but, evaporation being greater, there will be a greater cooling effect. In vesicular vapour, the reverse is found to hold in both respects. Thus, at inferior temperatures, the two agents which influence the heat of the body, are opposed, in their action, and, therefore, counterbalance one another. It is proved by experiments, that refrigeration is the same in dry, and in humid air; whence it follows that the cold produced by the greater evaporation in the former is balanced by the cold which results from the contact of the latter. After detailing his experiments upon this subject, Dr. Edwards observes, "It appears a generally established opinion, that we experience a greater cooling effect, in humid, than in dry, air." This is the case at Madeira, where several invalids, who had resided on the continent found themselves much colder, although they

observed that the temperature, at the time, was several degrees higher.

Dr. Edwards maintains that this is evidently founded on sensation, and other effects produced on the animal system; whence, it might be inferred that the cooling power of evaporation, in dry air, is more than equalled by that of the contact of transparent vapour; although, by experiment, he found it not to be the case.

From the preceding details we may draw the conclusion, that the extent to which the different atmospheric conditions influence the functions of the body, is determined by the modified state of the organization; and by the power which it exerts in promoting, or controlling, the purely physical effects of the atmosphere. In some instances, we see that evaporation acts upon the body, in a purely physical manner—just as it operates upon dead matter; while, in others, we observe that the organization modifies its properties, and proportions them to the wants of the system. In others again, we remark a combination of the two preceding phenomena; some processes being performed in opposition to physical causes, which, notwithstanding, modify the functions that thus affect them—and this is *generally* the case—so that, as we advance in life, physical agents have a greater influence upon us, until, at last, they gain the ascendancy over life itself.

CONCLUSIONS FROM THE FOREGOING DETAILS.

1.—All temperatures inferior to that of the body will not alter the quantity of oxygen in a given quantity of atmospheric air, which, in the act of respiration, is always raised to nearly the same temperature, as that of the body.

2.—If the temperature of the air be higher than that of the body, the quantity of oxygen, in a given space, will be proportionally diminished.

3.—During respiration, air, below the temperature of the body, will act as a refrigerator; the quantity of heat withdrawn being proportionally greater.

4.—The quantity of oxygen, in a given portion of atmospheric air, will vary according to the density of the atmosphere; which is greater when the barometer is at 30 inches, and less in proportion to every diminution of pressure.

5.—In a given portion of atmospheric air, more oxygen will be brought into contact with the lungs at the level of the sea, than in a mountainous country; the quantity gradually decreasing with every elevation above the level of the sea.

6.—The hygrometric condition of the atmosphere has no influence in diminishing, or increasing, the quantity of oxygen in a given portion of air, when in contact with the lungs; the air, in a healthy condition of the organization, being fully saturated, and consequently existing always under one expansion.

7.—Pulmonary exhalation and cutaneous insensible perspiration, or evaporation, are to be regarded as physical phenomena; and, consequently, are increased or diminished by physical causes.

8.—Every other condition being equal, perspiration by evaporation will be increased in proportion to the dryness of the atmosphere, or to its distance from the point of saturation.

9.—Every degree of temperature, inferior to that of the body, will act in increasing the dryness of atmospheric air, in immediate contact with the body; the heat changing its hygrometric condition, and rendering it drier, in proportion as the temperature of the air is further removed from that of the body.

10.—The agitation of the air promotes insensible perspiration from the skin, in proportion to its dryness and velocity.

11.—A rarified state of the atmosphere increases perspiration by evaporation, both from the skin and lungs.

12.—Every other condition being equal, both pulmonary and cutaneous evaporation are impeded in proportion as the air comes nearer to the point of full saturation.

13.—Both are decreased, in proportion as the temperature of the atmosphere approaches to that of the body.

14.—Both are impeded by a dense elastic condition of the atmosphere, indicated by a high barometric pressure.

15.—Every other condition being equal, insensible perspiration by the skin is diminished, in proportion to the tranquillity of the air.

16.—Both sensible and insensible perspiration are entirely suppressed; provided the air be of the same temperature as the body, and be fully saturated with vapour.

17.—Sweat, or perspiration by transudation, being a vital function, and acting as a regulator to the quantity of fluid given off from the skin and lungs, takes place in exact proportion, as perspiration by evaporation from the skin and lungs becomes impeded.

18.—This function is very little affected by temperature from 32° to 68°, Fahrenheit; but, from 78°, Fahrenheit, it takes place more rapidly than the increase of temperature would indicate; acting in proportion to the diminution of insensible perspiration from the lungs and skin.

19.—When, under the ordinary condition of the atmosphere, the body is at rest; this secretion, as soon as formed, is converted into vapour; being added to perspiration by evaporation.

20.—When, during any exertion of the body, under ordinary circumstances, it is secreted in greater quantity than the hygrometric condition of the air will support in the state of vapour; it appears on the surface in the form of sweat.

21.—The same phenomena will take place when at rest; provided the air be so charged with vapour as greatly to impede pulmonary and cutaneous exhalation.

22.—When transudation, or sweat, covers the whole body, perspiration, by evaporation from the skin, is suppressed; the contact of atmospheric air being precluded from the skin.

23.—When this is the case, evaporation will go on from the surface of the fluid secreted; and that, in proportion as the temperature, and hygrometric condition of the atmosphere, favour evaporation.

24.—The cold, produced by this process, will be very great; heat being abstracted from the body in proportion as its temperature is above that of the air; every grain of sensible perspiration requiring as much caloric to convert it into vapour, as would raise 1000 grains of water, one degree.

25.—The rapidity with which this reduction of temperature takes place, will be in proportion to every cause which promotes evaporation.

26.—Caloric is abstracted from the body in proportion to the velocity of the air, whatever be its hygrometric condition; and more so, in proportion to the lowness of its temperature, compared with that of the body.

27.—Refrigeration takes place, equally, in dry and in humid air.

28.—That sensation of cold which we experience in humid air must be attributed to some other influence than that, which, in this condition of the atmosphere the mean temperature exerts upon the system.

CHAPTER XII.

EFFECTS OF *LESTE* ON THE ANIMAL ECONOMY.

We may now make a few remarks on the influence which the *Leste* exerts on the animal economy. We may divide individuals herein to three classes, viz. :—

1.—Natives, or foreigners, long resident in the Island.

2.—Invalids who may have lately arrived, and with whom the climate agrees, and persons in health.

3.—Those who feel its beneficial influence, and in whom the general condition of the atmosphere produces injurious results.

First.—Residents of long standing, and in health do not experience any ill effects beyond the annoying sensation of general heat and oppression. The surface of the body is dry, perspiration appearing to be thoroughly arrested; the lips and nose feel as though they suffered from a recent cold.

The looks of these persons perfectly accord with their sensations during the continuance of this wind; still they do not avoid quitting their houses, though they always close both the windows and doors. Birds and insects seem to suffer more or less, and fowls, confined in a close yard, are generally observed to droop.

Second.—Delicate people, or persons in health, lately arrived, find their breath hot, their lips parched; while their faces and such other parts of the bodies as are exposed to the air, feel as though they were frost-bitten; and assimilate their sensations to what they have experienced in a northern climate, when exposed to a keen easterly wind on a frosty day. Pains in the head are generally complained of, as well as great thirst and general languor, with a feeling of faintness, loss of appetite, and inability to take their accustomed exercise, whether within or without doors. These results are accompanied with an unusually irritable state of the mind. The moment this wind approaches, the change which it effects on the conditions of the atmosphere is perceived, and every one feels as if he were suddenly transported into another climate. Both natives and strangers partake plentifully of lemonade and other cooling drinks, which, however, produce only a momentary effect, in allaying the painful sensation of thirst.

Third.—Those with whom the *Leste* agrees, do not complain of heat or thirst. They feel cheerful and much exhilarated in spirits; they can take

much more exercise, without feeling any languor, or being in a state of sensible perspiration, which, in ordinary weather, is always the case with them.

This was particularly exemplified in myself, and although the temperature was so high that, in the ordinary condition of the atmosphere, sensible perspiration would have been induced even when at rest, I could now take three times as much exercise, and remain quite free from moisture on my linen or even skin, feeling dry and comfortable, without the least sensation of languor or oppression. In the customary state of the atmosphere, during my residence at Madeira, even after a very moderate degree of exertion, I was always obliged to change my flannel and body linen, as I was bathed in perspiration, never unattended by a great degree of languor and lassitude.

These phenomena will be easily solved, when we consider that the insensible perspiration, both by the skin and lungs, will be from eight to ten times greater than in the ordinary condition of the atmosphere; and that, from the lungs alone, there is an increase of aqueous vapour given off to the amount of 3 oz. 12 drs. 12 grs. in twenty-four hours. It is no wonder, then, that in the case of persons in health, and of those to whom the increase of evaporation from the lungs and skin would be injurious, this sudden and almost momentary transition from humidity to extreme dryness, should be followed by palpable effects, and those either of an inconvenient or pernicious nature.

The same phenomena takes place in our own climate, although, apparently, under circumstances diametrically the reverse, but, from calculation, we find that dry frosty weather exerts the same influence on the human body; its own temperature determining the effect of the hygrometric condition of the atmosphere.

On the other hand it is easy to imagine the beneficial results, likely to accrue in an opposite constitution; viz., that, where evaporation from the skin and lungs would be serviceable, such a condition of the atmosphere would tend most powerfully to promote the recovery of the patient.

What I advanced, in a former part of this work, respecting the criterion whereby the suitableness or unsuitableness of the Madeira climate may be ascertained, may now be fully appreciated; and accordingly, it may not be improper to restate it. Those who, on their arrival, find that the *Leste* agrees with them, had better immediately remove to a drier climate; while those, with whom it materially disagrees, as indicated by the symptoms which I have described, may rest assured that they will derive permanent benefit from remaining; that their hopes will not be blighted; but that returning health and strength will result from leaving, for a season, their own less hospitable climate. As regards a suitable climate for the two opposite kinds of constitutions, namely, that which agrees with the *Leste*, and that upon which it operates unfavourably, we must bear in mind that every other condition being

equal, the quantity of water given off from the lungs and skin by perspiration, or by evaporation, must be proportionate to the dryness of the air, hence the utility of multiplied hygrometric observations in different countries, and in various localities in the same country. All pulmonary diseases being modified by the hygrometric state of the air —in affections of the lungs, attended by an excessive secretion; or in diseases of the skin, where the lungs are called upon to act more vigorously; or in any case where the cells of the lungs are obstructed from infiltration or otherwise; a dry temperate air will prove to be the most serviceable.

On the other hand, if there be diminished secretion from the lining membrane of the lungs —as a dry air will irritate this membrane, by removing the portion of aqueous vapour necessary for the maintenance of its healthy action; a warm moist atmosphere will be of the greatest utility; as it contains more aqueous vapour; and will, consequently, abstract less vapour from these organs. The skin under these circumstances will be, also, restrained from throwing out a superabundance of those aqueous particles, a due retention of which, within the body, is necessary to the maintaining of a healthy action.

Where *a very humid* condition of the atmosphere is required; the nearer its temperature approaches to that of the body, when the hygrometer, in other respects, indicates moisture, the closer will be the approximation to those conditions which are likely

to benefit the patient—provided all other things be equal.

On the other hand, where a *dry* air is required, much will depend upon the capability of the individual in generating heat; as air will be the more dry, the further it is removed from the mean temperature of the body. For, as we have already shown, provided an individual always maintain a sufficient temperature, the hygrometric condition of the air, as regards its distance from the point of saturation, would make little difference in the amount of vaporous perspiration; for, although saturated, being colder than the body, it will become comparatively dry when raised, many degrees, by inhalation, or external contact.

To place an individual under the most favourable circumstances for his recovery, appears, at first sight, to be an easy task, as all that seems necessary is the consideration of temperature; but the case is different if we recollect that the terms, heat and cold, are purely relative ones, when applied to the animal economy; and not only with reference to different species, but to individuals of the same species; when existing under a peculiar state of the system. We know that the quantity of heat, generated, bears a relation to the quantity of oxygen, consumed; and that the acceleration of respiration is a powerful agent in counteracting the effects of cold; but this acceleration has its limits, as it may diminish, but cannot compensate for, the effects of excessive cold. Now, since there is

a range of temperature, the variations within which scarcely influence the rapidity of the respiratory movements; and since this latitude is greater or less according to the constitution of the individual; it is of importance that it should be ascertained with the greatest precision; because, if we know the kind of constitution, which, in the variations of external temperature, preserves, more or less, that rhythm of respiratory movements, which characterises health; we shall be the better able to maintain it; or, when it is deranged, either by the conditions of the system, or by the hygrometric state of the atmosphere, we shall be the better enabled to place the individual in that locality which will most conduce to its re-establishment.

But, as in cases of small or diseased lungs, the oxygen, consumed, is not sufficient to enable the individual to produce the necessary degree of heat, it is evident that, howsoever beneficial a dry state of the atmosphere may prove, in other respects; to place him under a range of temperature, lower than what is absolutely necessary for healthy action, would only operate in inducinga tendency to general inactivity.

From these facts it follows, that, when an individual experiences such a change of constitution, as diminishes his power of producing heat, or consuming air; a drier atmosphere being required, he can only be placed under the most favourable circumstances for recovery, by resorting to a milder climate, in which the hygrometer indicates that the

atmosphere is very far removed from the point of saturation, or by effecting that condition through the employment of artificial means.

With regard to the electrical condition of the atmosphere, as I have alluded to Dr. Heineken's remark that the electrometer is very feebly effected, I have nothing further to offer. A knowledge of the electric condition, during the prevalence of the hot dry winds, would be very interesting. As far as sensation can indicate that state, I should be inclined to think that it was abundant, having suffered very severely from the *Leste* after being much exposed to its influence during some of my experiments on the subject. I am induced to mention this circumstance from having read the following quotation in the Appendix of "Edwards on Physical Agents," by Dr. Hodgkin. He observes, "It is well known that that state of the atmosphere which is unfavourable to electrical experiments from its being adverse to insulation, and consequently to the electric tension of bodies, is also ungrateful and oppressive to our feelings, and that precisely the opposite effect is experienced in clear and frosty weather, and in other states of the atmosphere which facilitate the working of electrical machines. We might regard these as coincident, rather than connected, facts, if it had not been observed that an artificial repletion with electric fluid produced a similar effect in exhilarating the spirits; a result, for the knowledge of which, I am indebted to my friend Charles Woodward, of

Islington, a gentleman who has long and successfully devoted his attention to electricity." In the ordinary condition of the atmosphere, at Madeira, I generally experienced a depression of spirits with general languor. On the other hand, during the prevalence of the *Leste*, my spirits were very much exhilarated; and, although the temperature was 86°, I never felt any languor; but, on the contrary, such a general alacrity and vigour about the whole system, as I never experienced under any other circumstances.

On the 22d and 23d of October, the *Leste* was very severe; the hygrometer, by evaporation, indicating from 20° to 22° of dryness. The first day I was fully exposed to its influence, also to great solar radiation; the black-wooled thermometer indicating 160° of Fahrenheit. I enjoyed it much, and felt no oppressive effects from it. The wind blew very strong, which increased its drying influence on the body. On the 23d I was well, up to 10 a.m.; but, at that hour, was seized, almost instantaneously, with pains at the pit of the stomach; which shot to the back and loins, and towards the region of the kidneys. The abdomen was very tense, with pain on pressure; which also was the case in the urinary region.

The bowels were constipated, and the rectum appeared to be drawn up. The usual quantity of aperient medicine had little or no effect. The sensations, at the commencement of a paroxysm, were of a very peculiar nature, exciting an almost irre-

sistible tendency to laughter, which soon amounted to a sense of the most intolerable pain. I could not remain above a few minutes in one position, most particularly whilst lying on the left side; and the only posture which procured any relief was that which is adapted to the operation for lithotomy, the hands grasping the feet with powerful exertion. I experienced much sickness and nausea, and vomited a considerable quantity of acid matter, while I suffered great thirst, with a perfectly dry skin.

The head, however, was not the least affected; so that, during the intervals of extreme pain, I could have prosecuted any mental pursuit. Whatever was taken into the stomach produced distress. Warm water, with a little compound spirits of ammonia, was productive of almost immediate vomiting. I afterwards tried twenty minims of the liquor morphiæ, in water, but without any diminution of the symptoms. At 3 p.m., the hygrometer indicated 17° of dryness, and commenced to decrease about 4 p.m. At 6 p.m. it was only 7°, and the following morning was reduced to 2°, or near the point of saturation. The symptoms began to decrease about 4 p.m., when copious perspiration followed; so much so, that two night-shirts were soaked, in the space of three hours. At 9, the same evening, I felt perfectly well, but very prostrate; a state which lasted about a week.

Whether to attribute those symptoms to the extreme dryness, along with the influence of great

solar radiation; or to some electrical condition of the atmosphere; I do not know. The absence of any uneasiness in the head, connected with that peculiar sensation which induced an irrepressible desire to laugh, would indicate the latter; while the pain in the region of the kidneys, vomiting, &c., would favour the former opinion. The case is interesting; and may lead, along with many others, to prove the great influence which any peculiar condition of the atmosphere exerts upon our organization.*

* A case, illustrating similar phenomena, will be found in the *Medical Gazette*, April 9th, 1836, in a paper, by J. J. Russell, Esq., 73rd Regiment, on *Coup de Soleil.*

CHAPTER XIII.

SUMMARY OF THE CHIEF DIFFERENCES BETWEEN THE CLIMATES OF LONDON AND MADEIRA.

I SHALL now draw up, in a tabular form, the difference between the climates of Madeira and London, in relation to the functions of respiration and perspiration; and, then, offer a few general remarks, with regard to the hygrometrical condition of the atmosphere, as influencing perspiration by evaporation.

CLIMATE OF LONDON.

1.—The air, inspired, will abstract a larger quantity of caloric from the body, in proportion as 50° is lower than 66°. in each act of respiration.

2.—The quantity of oxygen in a given space is less in London, as 29.881, the mean height of the barometer, there, is less than 30.030, its mean annual height, in Madeira.

3.—Respiration by evaporation, both from the skin and lungs, is greater in London—the distance from the point of saturation being the same—in proportion as the number of degrees, between the mean temperature of Madeira and that City, differs from that of the body. The mean temperature of London is capable of holding 4.535 grains, per cubic foot, of aqueous vapour; whereas the mean of Madeira will hold 7.447 grains; and, moreover, the atmospheric pressure is less, in the latter locality.

4.—The agitation of the air, either through the medium of currents or exercise, in regard to promoting insensible perspiration from the skin; is greater in London, in proportion as its mean dryness, in relation to the functions of the body, exceeds that of Madeira.

5.—Perspiration by transudation is less in London, in proportion as perspiration by evaporation is increased.

6.—When the surface of the body becomes covered with sensible perspiration, in London, it is more likely to be followed by fatal consequences; evaporation being greater, and the temperature of the air less, than at Madeira; consequently, more caloric will be abstracted from the body, and with much greater rapidity. Hence the necessity of avoiding currents of air, and changing the body linen.

7.—Caloric will be more rapidly abstracted from the body, and in greater proportion, according to

the velocity of the wind in London; the mean temperature being further removed from that of the body, than the mean temperature of Madeira.

8.—The influence of light is less in London, than in Madeira.

9.—In its effects on the animal economy, our summer season will approach to the Madeira climate; being slightly modified by temperature and hygrometric condition.

CLIMATE OF MADEIRA.

1.—The air, inspired, will abstract less caloric from the body in each act of respiration, in proportion as 66° is higher than 50°.

2.—The quantity of oxygen, in a given space at the level of the sea, is greater in Madeira, as 30.030 inches, the mean height of the barometer there exceeds 29.881, its mean annual height at London.

3.—The distance from the point of saturation being equal, perspiration by evaporation, both from the skin and lungs, is less in Madeira; in proportion as 66°, its mean temperature, approaches that of the body; being capable of supporting 7.447 grains of aqueous vapour, per cubic foot, and the atmospheric pressure being greater.

4.—The agitation of the air, through the medium of currents or exercise, promotes insensible perspiration by the skin, in a less degree in Madeira, in proportion as its humidity, in relation to the functions of perspiration, exceeds that of London.

5.—Perspiration by transudation, is increased, in proportion as perspiration by evaporation, is diminished.

6.—When the surface of the body becomes covered with sensible perspiration, in Madeira, it is not so likely to be followed by dangerous results as in London; evaporation being less and the heat of the air greater in the former than in the latter locality; less caloric will, consequently, be given off from the body, and with much less rapidity.

7.—Caloric will be less rapidly abstracted from the body, in Madeira, and in less quantity, according to the velocity of the wind; the mean temperature approaching more or less to that of the body.

8.—The influence of light is greater in Madeira, than in London.

9.—The temporary climate, produced by the *Leste*, approaches, in its hygrometric condition, and in its action on the animal economy, our own winter season; the dryness of the former being produced by its distance from saturation; while, in the latter, it is determined by the lowness of temperature; the hygrometric state of the air being changed upon coming in contact with the body. As regards temperature, the result is quite the reverse.

CHAPTER XIV.

GENERAL EFFECTS OF CLIMATE.

From the preceding observations, it will be clearly perceived, that temperature exerts a far greater influence over many of the functions of the animal economy, than, at the outset, we should be inclined to credit; seeing that it so much affects the hygrometric condition of atmospheric air, in relation to its influence on the organization: rendering it—*cæteris paribus*—drier, or more humid, in proportion as its temperature becomes further removed from, or approximates nearer to, that of the human body.

This being the case, it is not wonderful that the mean annual heat of any climate; its extreme range of temperature—not only during particular seasons, but also in each month; the usual mean of such month, and its daily variations; must exert a manifest influence upon the human frame; and that, also, in proportion to any sudden variation of

temperature; the system not being able to adapt itself to the new relations which must exist between it, and the medium by which it is surrounded.

Let us see how this holds with regard to the effects of different countries, and various localities of the same country.

In countries or districts, situated near the sea, or in the vicinity of lakes or large rivers, the extremes of heat are moderated; the air is more humid; and the changes of season more uncertain and variable. The greater humidity of the air arises from its relation to the functions of perspiration by evaporation: first, because its temperature will approach nearer to that of the body; secondly, because being higher, than in inland or mountainous districts, it will contain more aqueous vapour in a given space, supposing it to be fully saturated. On the contrary, in countries or districts that lie far inland, and are free from lakes and large rivers; the range of atmospheric temperature is greater—particularly in places, considerably elevated above the sea; while the air, even supposing it to be saturated, is remarkably dry, in its action on the system, when compared with that of countries or districts near the sea coast. In the first place, because its temperature is farther removed from that of the body; in the next place, because it contains, in a given space, less aqueous vapour, in proportion to the difference of temperature; and, in the third place, supposing the locality to be considerably elevated above the surface of the sea, the pressure of the atmosphere

being less, perspiration by evaporation will be increased. The inhabitants, therefore, will breathe a drier, purer, and cooler air, than those who reside in the former situation; where the atmosphere, generally, is more abundantly supplied with emanations, arising from the decomposition of vegetable and animal substances, facilitated by a higher and more humid temperature.

Consequently, the inhabitants, living in those more elevated situations, in the same latitude, are more athletic, less subject to febrile diseases of a malignant character, and, generally, reach more advanced ages.

This is chiefly shown in warm climates, and the more southerly parts of temperate countries. In low situations of the same districts, situated near the sea coast, or in the immediate vicinity of lakes, or the estuaries of large rivers, where the soil is rich, and abounds in organic substances in a state of decay; the temperature and increased humidity, facilitating that process, by which the atmosphere becomes loaded with effluvia, the inhabitants are more imperfectly and weakly constituted, a much smaller portion of children are reared, and viscernal and glandular diseases abound. This is obvious even in Madeira; where the inhabitants of the north of the Island are found to be a much finer race; better looking, less deformed, and less haggard, than those that reside on the south side, in the immediate vicinity of the sea; a fact that is at once accounted for, when it is recollected that, in

more elevated situations, where the temperature is further removed from that of the body, perspiration, by evaporation, both from the skin and lungs, must be more free; and, consequently, more under the control of organized structure; the hygrometric state of the air, in relation to its influence on animal life, depending, greatly, on the facility with which heat is generated.

We, therefore, find, as theory would indicate, that affections of the chest and respiratory organs; inflammatory fevers, complicated with inflammation of the lungs; and rheumatism, in its several forms; are the most prevalent diseases in localities where the temperature varies to a great extent; or is subject to sudden vicissitudes which cause similar differences in the hygrometric condition of the atmosphere, relative to the quantity of fluid excreted from the body, by means of cutaneous perspiration and exhalation from the respiratory organs. It also may be observed that, where this excretion is impeded, so as to render the system replete with too great a quantity of aqueous particles; vascular depletions are more required; and are better borne, in the treatment of the various ailments to which the body is liable.

On the contrary, in tropical countries, where the heat is nearer to that of the body, and the atmospheric air contains a much larger portion of aqueous vapour in a given space—both these circumstances impeding perspiration by evaporation—we should naturally expect, not only that the or-

ganization would be modified, so as to place it in relation with the opposite conditions of the atmosphere, by which it is surrounded; but that the diseases to which it is liable would be altered in their character, and would not affect the same organs that suffer in individuals, existing under the influence of a comparatively low degree of temperature.

As the function of perspiration by evaporation is so much under the influence of temperature, and of the distance from the point of saturation; we should naturally be led to conclude, that, in tropical countries, the diminution of perspiration by evaporation would be compensated for by increased transudation or sweat, and that the functions of the skin would be modified. We should, therefore, expect that the organization of the skin would be very different in persons, born under a tropical sun; and that individuals arriving from a colder climate would be liable to suffer from diseases of this surface, and of the organs which act in close sympathy with it, until at length it should become gradually modified by the influence of climate; first, in themselves, and to a greater extent afterwards in their progeny, who would grow more and more assimilated to the natives of those countries, in each successive generation.

In confirmation of this theory, drawn from physiological premises, I may quote what Dr. Copland advances on the subject. He observes that, "there are certain peculiarities in the natives of temperate

countries—particularly European—that must strike the pathologist as intimately connected with the nature and treatment of their diseases.

These are, chiefly, the *complexion* of the skin; and the large development of the respiratory, biliary, nervous, and circulating organs, compared with those of the natives of intertropical countries.

The *skin* of the dark races is not only different in colour, but it is also *considerably modified in texture;* so as to enable it to perform a greater extent of function, than the more delicately-formed skin of the white variety of the species.

The thick and dark *rete mucosum* of the former, is, evidently, better suited to the warm, moist, and *miasmal climates* of the tropics, than that with which the latter variety is provided.

The skin of the negro is a much more active organ of *depuration* than that of the white. It not merely *exhales a larger portion of aqueous fluid*, and carbonic acid from the blood, but it also elaborates a more unctuous secretion, which, by its abundance and sensible properties, evidently possesses a very considerable influence in counteracting the heating effects of the sun's rays upon the body, and in carrying off the superabundant caloric. Whilst the active functions of the skin, aided by the colour, thus tend to diminish the heat of the body; and, to prevent its excessive increase by the temperature of the climate; those materials that require removal from the blood, are eliminated by *this surface;* which, in the negro especially, performs

excreting functions, very evidently in aid of those of *respiration*, and of biliary secretion. In the white variety of the species, on the other hand, the functions of the lungs and liver are much more active than in the darker races; changes to a greater extent being performed by respiration in the former than in the latter, as I have proved by experiment. The liver is also larger, and its secretions more copious in the European, than in the negro or mongol.

In the inhabitants of the northern climates, and elevated and cold countries, the functions of the lungs and kidneys are extremely prominent, and those of the skin and liver much less so; eliminating or depurating actions on the blood, being performed chiefly by the former organs. But in the natives of intertropical climates the skin assumes, as shown above, a more extensive function; and, by its *activity*, compensates for the diminished operation of the *lungs*, liver, and kidneys, generally observed among them, aided, no doubt, by the secretions of the intestinal mucous surface.

In temperate countries, the various emunctories of the frame present a degree of activity, in strict keeping with this general connection of climate, with the development and activity of these functions.

In warmer districts of temperate climates, and especially in those which are subjected to a *dense*, *moist*, and *miasmal* atmosphere, the changes produced by respiration, are *diminished;* and those,

affected by the cutaneous and intestinal mucous surfaces, are increased. If the natives of such districts belong to the white variety of the species, their *cutaneous surface not being constituted* so as to enable it to perform the *compensating action* for which the skin of the darker races is destined, a different organ performs this office; and the liver assumes an increased action, combining and eliminating several of the effete constituents or elements as they accumulate in the circulation; and thereby giving rise to an increased and modified biliary secretion.

If we compare the organization and functions of the negro, with those of the European, the following general results will appear; and, together with what has been now advanced, will serve as the source of very important pathological and therapeutical inductions.

The circulating organs, the lungs, the liver, the middle and anterior lobes and convolutions of the brain, the muscles, and the bones—excepting those of the head and face—are very evidently smaller, and their functions less prominent in the former than in the latter variety; whilst, on the other hand, the *skin* and its functions are much more developed; from which cause, conjoined with frequent exposure to the action of numerous excitants, the disposition to disorder increases; and, accordingly, diseases of the lungs and circulating organs, of the liver, and of the nervous system, predominate in the white races of man; and *chronic affections of*

the skin, and those acute maladies which chiefly attack this surface, and the intestinal mucous membrane; in the dark variety of the species. Amongst the latter, fevers are not common; and, when they occur, are usually slight, terminate speedily, seldom assume an inflammatory or continued type, often pass off with critical discharges from the skin and bowels, and not unfrequently lapse into a state of low or chronic dysentery. The exanthematous diseases generally assume, in them, a severe and asthenic form; and rapidly spread by infection. Verminous disorders are very common in them, but affections of the brain and its membranes, and of the teeth, are extremely rare; the cranial contents seldom suffering materially in the course of febrile attacks."

Having seen that the organization is affected by climate, let us inquire what effect the sudden transition from one climate to another will produce in modifying the character of disease; so that we may be enabled to place the human frame in the condition most favourable to health. We have proved that, by such a transition, the organization may be placed under circumstances unfavourable for the continuance of healthy action, inasmuch as the different organs of the body are not prepared to act in concert with the new medium by which it is surrounded; and the system is unable to adapt itself, immediately, to any sudden change from one extreme to the opposite. When a European migrates into an intertropical country, we find

that the high range of temperature, together with the moist miasmal air, produces a diminution of the changes, effected by respiration in the blood. Perspiration by evaporation from the lungs being greatly impeded, if not in many cases almost entirely arrested; the insensible perspiration from the skin becoming, also, impeded by similar causes; the secreting and excreting functions of the liver and skin are greatly increased; there is a marked diminution of the secretion from the kidneys; and hence arise diseases of the liver and of the cutaneous surface. For, as the functions of the lungs, and, consequently, pulmonary exhalation, become diminished; the requisite changes are not effected in the blood, notwithstanding the excitement of the nervous and vascular systems by the increased temperature; the already active and distended liver is irritated, and has its functions augmented by the increase of those elements in the blood, that the lungs and skin, in this new medium, are unable to remove from it; the mucous coat of the alimentary canal becomes also disordered; thus further complicating, by the sympathy existing between it and the other abdominal viscera, those peculiar trains of symptoms to which individuals so circumstanced usually fall victims.

On the contrary, in migrating from a warm to a cold climate the reverse takes place. Transudation will gradually be impeded by the lowness of temperature, and evaporation, from the surface of that which is poured out upon the skin, will produce a

degree of cold to which the system is unaccustomed, and which tends more and more to restrain this secretion ; while the skin, not being organized so as to permit perspiration by evaporation, to an extent sufficient to compensate for the diminution of sensible perspiration ; and this process being further checked by the inability of the body to generate sufficient heat—as we shall afterwards see —the most momentous changes in the play of the varied functions, necessary for the maintenance of life, will be naturally produced.

In the first place, the free circulation of the blood on the cutaneous surface will be prevented. This will determine an increased flow of blood to the large internal viscera, occasioning congestion or obstruction, in the circulation of those organs ; and thus giving rise to tubercular affections and diseases of the bronchi, as well as to those to which the alimentary canal and kidneys are liable.

The cold will also produce a depressing influence upon the nervous system, and upon the vital action of the lungs and skin ; whence, an individual, so circumstanced, will not generate animal heat, sufficient to change the hygrometric condition of the air ; and to enable perspiration by evaporation to compensate for the diminution of transudation, produced by the contact of cold air with the surface. Thus, both these essential depurating sources becoming impeded, the whole mass of circulating fluid will be altered in its character ; many of the changes, formerly produced by the lungs and skin,

having now to be performed by the liver, and kidneys, and by the mucous membrane of the alimentary canal; organs which, in the natural condition of the individual, were unaccustomed to such violent exertion; and which, not being adapted, or sufficiently developed, to produce those changes, soon become diseased from the over-action to which they are subjected, for the present maintenance of life.

To these causes, may be added the great abstraction of caloric from the lungs during each act of respiration; tending to lower the temperature of the body to that degree, that the continuance of the healthy action of the various functions will be rendered impossible. In estimating this effect, we must constantly bear in mind, that the terms, heat and cold, are altogether relative, as regards their action on the system; so that the functions of the body can only be performed within a certain range of temperature, for a certain time; the duration of which altogether depends upon the nature of the constitution, and its capability of either generating heat, or diffusing it into the medium by which it is surrounded. Above or below this *constitutional* range, every function of the body will cease to act, later or earlier, according to the extent to which the change may be carried in either direction; and to the rapidity with which it may be effected. In considering, therefore, the effects of heat and cold upon the body, due regard should be had to the state of the functions, by which heat is generated;

those functions being essentially vital; and acting with vigour, in proportion to the energies of the constitution.

In concluding this article, I may observe, that my chief object has been, to draw attention to the relations which exist between perspiration by evaporation, and the different hygrometric conditions of the atmosphere—particularly as regards the climates of London and Madeira; and to show, by positive data, the effects which different conditions of the atmosphere are likely to produce in affecting the healthy action of the system.

By the aid of modern science, we are far better enabled to appreciate the effects of climate on the constitution, than our ancestors were; as we can now arrive at positive conclusions, from simple and easy calculations—especially as relates to the quantity of vapour, in a given quantity of atmospheric air. For this we are particularly indebted to Dalton and Professor Daniel—both of whom have contributed, so largely, towards our knowledge of meteorology; a science, however, which is yet in its infancy; particularly, as regards atmospheric action on the animal frame. The electrical condition of the atmosphere, as well as the effect of solar radiation, have, hitherto, been almost entirely overlooked.

I would strenuously enforce upon the profession, generally, the absolute necessity of making extensive meteorological observations, as a means of materially advancing the science of medicine; for

our present knowledge of local climates, and even of that of our own country, is entirely unsupported by accurate data, founded on experiment. The attention of the scientific ought to be directed—first, to temperature; secondly, to the dewpoint, or the distance from the point of saturation; thirdly, to the pressure of the atmosphere; fourthly, to the rapidity of evaporation; fifthly, to the range and intensity of solar radiation; and, sixthly, to the different states of electric tension. Were all these causes, which are constantly varying, carefully registered; together with an account of the topographical relations of the place of observation; the geological and mineralogical formations, constituting the basis of its soil; its state of cultivation; the most frequent winds to which it is subject; the moral condition of its inhabitants; and the diseases prevailing at the time—especially their various types—we should then make rapid progress in meteorological science, and possess positive data, with reference to the action of different atmospheric conditions on the animal economy, both in its healthy as well as in its diseased state. It is impossible to calculate the benefits that would result from the information that would be thus acquired; not only as regards the medical practitioner, but as the public in general are concerned. It would enable the former to gain precise knowledge, as to the influence of the different atmospheric conditions, in producing, modifying, or arresting, the different forms of diseased action; whether arising from

functional derangement, or from the more serious modifications of structure, so that he could place his patients under the most auspicious circumstances, for bringing about the healthy condition of the functions; and it would qualify the latter to select such atmospheric conditions, as best conduce to the enjoyment of that existence, which, through ignorance or infatuation, is now, too frequently, rendered a helpless prey to disease.

PART III.

METEOROLOGICAL TABLES

FOR THE YEARS

1834 & 1835, AND 1848 & 1849.

DR. MASON'S TABLES.

EXTERNAL TEMPERATURE.

TABLE I.

SHOWING THE MEAN, MEAN MAXIMUM AND MEAN MINIMUM, TEMPERATURE FOR EACH MONTH; THE MEAN AND EXTREME MONTHLY RANGE OF TEMPERATURE; THE MEAN MAXIMUM POWER OF SOLAR RADIATION; THE UTMOST INTENSITY OF ITS RAYS, WITH THE EXTREME SOLAR RANGE DEDUCED FROM THE HIGHEST AND LOWEST MAXIMUM POWER OF THE SUN; ALONG WITH THE MEAN AND MAXIMUM POWER OF TERRESTRIAL RADIATION AT STA. LUZIA, FUNCHAL, MADEIRA.

1834 and 1835.	Mean.	Mean maximum.	Mean minimum.	Mean monthly range.	Maximum.	Minimum.	Extreme range.	Mean maximum power of solar radiation.	Mean power of the sun above the shade.	Maximum power of solar radiation.	Maximum intensity of the sun's rays above the shade.	Least maximum power of solar radiation.	Range between the highest maximum and lowest maximum.	Mean terrestrial radiation.	Maximum terrestrial radiation.
January	60°.24	63°.23	57°.26	5°.97	65°	55°	10°	85°.74	22°.51	120°	55°	62°	58°	—	—
February.........	61.12	64.75	57.50	7.25	69	55	14	99.25	34.50	120	51	75	45	—	—
March	63.43	68.39	58.48	9.81	71	53.5	17.5	116.88	48.49	142	71	80	62	—	—
April	65.39	70.46	60.33	10.13	75	58	17	120.66	50.20	162	87	88	74	—	—
May..............	67.97	72.60	63.35	9.25	77.5	61	16.5	125.77	53.17	170	92.5	74	96	—	—
June..............	69.44	73.16	65.73	7.43	80	63	17	125.24	52.08	170	90	78	92	—	—
July..............	71.68	75.06	68.29	6.77	80	66	14	130.51	55.45	152	72	86	66	—	—
August...........	72.78	76.93	68.64	8.29	80	66	14	142.71	65.78	162	82	90	72	2°.60	7°
September	72.16	76.00	68.32	7.68	79	66	13	130.65	54.65	156	77	82	74	6.25	8
October..........	69.49	73.06	65.93	7.13	77	62	15	111.50	38.44	139	62	75	64	5.70	8
November	65.45	68.70	62.20	6.50	73	57	16	115 60	46.90	146	73	76	70	6.00	10
December	64.25	66.80	61.71	5.09	72	55	17	92.51	32.71	125	53	70	55	5.48	15

The following Table presents the average intensity of solar radiation for every month in the year; or the mean greatest height of the black thermometer above the surrounding medium; together with the utmost intensity, observed during the same periods.—

TABLE II.

SHOWING THE MEAN MAXIMUM TEMPERATURE, WITH THE MEAN AND MAXIMUM POWER OF THE SUN FOR EVERY MONTH IN THE YEAR.

CLIMATE OF LONDON, Daniel.	Mean maximum of the air.	Mean maximum force of solar radiation.	Maximum force of solar radiation.
January	39°.6	4°.4	12°
February	42.4	10.1	36
March	50.1	16.0	49
April	57.7	28.1	47
May	62.9	30.5	57
June	69.4	39.9	65
July	69.2	35.8	55
August	70.1	33.1	59
September	65.6	32.7	54
October	55.7	27.5	43
November	47.5	6.7	34
December	43.2	5.4	12

TABLE III.

SHOWING THE MEAN MAXIMUM TEMPERATURE OF THE AIR, WITH THE MEAN AND MAXIMUM POWER OF THE SUN FOR THE SEASONS, AND FOR THE WHOLE YEAR.

CLIMATE OF LONDON, Daniel.	Winter.	Spring.	Summer.	Autumn.	Year.
Mean maximum of the air	41°.7	56°.9	69°.6	56°.3	56°.1
Mean maximum force of solar radiation	6.6	24.9	36.3	22.3	22.5
Maximum force of solar radiation	20.00	51.00	59.66	43.66	43.58

The following Table presents the average intensity of solar radiation for every month in the year; or the mean greatest height of the black thermometer above the surrounding medium, together with the utmost intensity; observed during the same periods in the Climate of Madeira; Sta. Luzia, Mount road, 300 feet above the sea.—

TABLE IV.

SHOWING THE MEAN MAXIMUM TEMPERATURE OF THE AIR, WITH THE MEAN AND MAXIMUM POWER OF THE SUN FOR EVERY MONTH IN THE YEAR.

Sta. Luzia, Funchal, Madeira, 1834-5.	Mean maximum of air.	Mean maximum of solar radiation.	Maximum force of solar radiation.
January	63°.23	22°.51	55°
February	64.74	34.50	51
March	68.39	48.49	71
April	70.46	50.20	87
May	72.60	53.17	92.5
June	73.16	52.08	90
July	75.60	55.45	72
August	76.93	65.78	82
September	70.00	54.65	77
October	73.06	38.44	62
November	68.70	46.90	73
December	66.80	32.71	53

TABLE V.

SHOWING THE MEAN AND MAXIMUM TEMPERATURE OF THE AIR, WITH THE MEAN AND MAXIMUM POWER OF THE SUN FOR THE SEASONS, AND THE WHOLE YEAR.

Sta. Luzia, Funchal, Madeira, 1834-5.	Winter.	Spring.	Summer.	Autumn.	Year.
Mean maximum of air	64°.92	70°.48	75°.23	70°.58	70°.30
Mean maximum of solar radiation	29.90	50.62	57.77	46.66	46.24
Maximum force of solar radiation	53.00	83.50	81.00	70.00	71.87

TABLE VI.

SHOWING WHEN ANY PART OF THE DAY AND NIGHT WAS FINE, CLOUDY, OR VARIABLE, AND WHEN ANY RAIN FELL IN EACH MONTH; WITH THE NUMBER OF HOURS ACTUALLY FINE, CLOUDY, OR RAINY, DURING THE SAME PERIODS; ALSO THE NUMBER OF DAYS DURING WHICH THUNDER OCCURRED.

STA. LUZIA, MADEIRA, 1834 AND 1835.	DAY.		NIGHT.		DAY.		NIGHT.		DAY.		NIGHT.		No. of days on which thunder occurred.
	Days fine.	Hours fine.	Nights fine.	Hours fine.	Days cloudy.	Hours cloudy.	Nights cloudy.	Hours cloudy.	Days rain.	Hours rain.	Nights rain.	Hours rain.	
January	14	87	11	132	26	211	18	195	14	74	6	45	NIGHT. 2
February	20	142	16	140	22	173	19	184	9	21	1	12	—
March	16	156	22	214	6	114	4	112	8	32	5	46	—
April	10	137	15	198	12	160	10	123	10	63	5	39	—
May	18	218	20	246	10	130	8	104	2	24	2	22	—
June	13	163	18	215	19	157	9	124	6	40	2	21	—
July	20	156	23	276	22	210	8	96	7	6	0	0	—
August	25	243	17	204	17	124	14	166	3	5	1	2	—
September	23	195	19	204	14	140	9	114	5	25	4	42	—
October	19	135	18	192	16	134	8	87	10	103	7	93	3
November	15	114	10	120	21	167	13	132	18	79	13	108	3
December	9	108	16	180	18	208	8	81	10	56	10	111	1

TABLE VII.

SHOWING WHEN ANY PART OF THE DAY AND NIGHT WAS FINE, CLOUDY, OR VARIABLE; AND WHEN ANY RAIN FELL DURING THE SEASONS, AND THE WHOLE YEAR; WITH THE NUMBER OF HOURS ACTUALLY FINE, CLOUDY, OR RAINY, DURING THE SAME PERIODS.

STA. LUZIA, FUNCHAL, MADEIRA, One Year, 1834-5.		Winter.	Spring.	Summer.	Autumn.	Year.
Days	Days fine	43	44	58	57	202
	Hours fine	337 = 28.1 D. H.	511 = 42.7 D. H.	562 = 46.10 D. H.	444 = 37.0 D. H.	1854 = 154.6 D. H.
Nights	Nights fine	43	57	58	47	205
	Hours fine	452 = 37.8	658 = 54.10	695 = 57.11	516 = 43.0	2321 = 192.7
Days	Days cloudy or variable	68	28	58	51	205
	Hours cloudy or variable	592 = 49.4	404 = 33.8	491 = 40.11	441 = 36.9	1928 = 160.8
Nights	Nights cloudy or variable	45	22	31	30	128
	Hours cloudy or variable	460 = 38.4	339 = 28.3	386 = 32.2	333 = 27.9	1515 = 126.3
Days	Days rainy	33	19	16	33	101
	Hours rainy	151 = 12.7	119 = 9.11	51 = 4.3	207 = 17.3	528 = 44.0
Nights	Nights rainy	17	11	3	24	55
	Hours rainy	168 = 14.0	107 = 8.11	23 = 1.11	243 = 20.3	541 = 45.1

EXTERNAL TEMPERATURE.

TABLE VIII.

SHOWING THE MAXIMUM AND MINIMUM TEMPERATURE OF THE DAY DURING THE MONTH, AND THE MAXIMUM AND MINIMUM OF THE NIGHT; OR THE DAILY AND NIGHTLY RANGE DURING EACH MONTH AND FOR THE WHOLE YEAR, INDEPENDENT OF *LESTE*, STA. LUZIA, MADEIRA, 1834-5.

Madeira, 1834-5.	Maximum in the day.	Minimum in the day.	Range.	Maximum in the night.	Minimum in the night.	Range.
January ...	65°	59°	6°	61°	55°	6°
February ..	69	60	9	62	55	7
March......	71	61	10	60	53.5	6.5
April	75	67	8	64	58	6
May	77.5	67	10.5	67	61	6
June	80	68	12	69	63	6
July	80	72	8	72	66	6
August ...	80	74	6	72.5	66	6.5
September.	79	72	7	72.5	66	6.5
October ...	77	68	9	69	62	7
November.	73	64	9	66	57	9
December..	72	64	8	65	55	10
Year	80	59	21	72.5	55	17.5

TABLE IX.

SHOWING TABLE VIII. WITH *LESTE*.

Sta. Luzia, Madeira, 1834-5.	Maximum day.	Minimum day.	Range.	Maximum night.	Minimum night.	Range.
March......	74°	61°	13°	66°	53.5°	12.5°
June	87	68	19	73.5	63	10.5
October ...	81	68	13	75	62	13
Year	87	59	28	75	55	20

INDOOR TEMPERATURE.

TABLE X.

SHOWING THE MEAN, MEAN MAXIMUM AND MEAN MINIMUM TEMPERATURE OF EACH MONTH, WITH, AND INDEPENDENT OF *LESTE*: ALSO, THE ABSOLUTE MAXIMUM AND MINIMUM, OR THE EXTREME RANGE; WITH THE MAXIMUM AND MINIMUM OF THE DAY, OR THE MONTHLY DAILY RANGE; THE MAXIMUM AND MINIMUM OF THE NIGHT, OR MONTHLY NIGHTLY RANGE, WITH, AND INDEPENDENT OF *LESTE*.

Sta. Luzia, Funchal, Madeira, 1834 and 1835.	Mean.	Mean maximum.	Mean minimum.	Mean range.	Maximum day.	Minimum night.	Extreme range.	Maximum with *Leste* day.	Extreme range with *Leste*.	Extreme monthly range, day.		Extreme monthly range, night.		Maximum with *Leste*, night.	Extreme range.
										Minimum in the day.	Daily range.	Maximum in the night.	Nightly range.		
January	60.94°	62.48°	59.41°	3.07°	65°	57°	8°	—	—	60°	5°	61.5°	4.5°	—	—
February	61.83	63.75	59.92	3.83	67	57	10	—	—	61	6	62	5	—	—
March	63.73	65.70	61.76	3.94	71	57	14	74°	17°	61	10	64	7	68°	11°
April	66.46	68.03	64.90	3.13	70	63	7	—	—	65.5	4.5	67.5	4.5	—	—
May	68.95	70.60	67.30	3.30	75	64	11	—	—	68.5	6.5	70	6	—	—
June	70.83	72.13	69.53	2.50	78	66	12	83	17	68	10	74	8	76.5	10.5
July	74.14	75.54	72.74	2.80	78	71	7	—	—	72	6	76	5	—	—
August	74.46	76.12	72.80	3.32	79	70	9	—	—	73	6	76	6	—	—
September	73.72	75.24	72.20	3.04	77	70	7	—	—	72	5	75	5	—	—
October	70.31	72.10	68.53	3.57	77	66	11	80	14	69	8	72	6	74	8
November	65.89	67.66	64.13	3.53	72	60	12	—	—	63	9	68	8	—	—
December	65.14	66.87	63.41	3.46	72	60	12	—	—	63	9	66	6	—	—

The internal daily range for the year is 19°; the internal nightly range is 19°; and the extreme range 22°.

EXTERNAL TEMPERATURE.

TABLE XI.

SHOWING THE MEAN MAXIMUM AND MINIMUM OF THE DAY, AND THE MEAN MAXIMUM AND MINIMUM OF THE NIGHT FOR THE SEASONS, AND FOR THE WHOLE YEAR, INDEPENDENT OF *LESTE;* OR THE MEAN DAILY AND NIGHTLY RANGE.

Sta. Luzia, Funchal, Madeira, 1834-5.	Mean maximum in the day.	Mean minimum in the day.	Mean range.	Mean maximum in the night.	Mean minimum in the night.	Mean range.	Range of the 24 hours.
Winter.......	68°.66	61°.00	7°.66	62°.66	55°.00	7°.66	13°.66
Spring	74.50	65.00	9.50	63.66	57.50	6.16	17.00
Summer	80.00	71.33	8.67	71.16	65.00	6.16	15.00
Autumn	76.33	68.00	8.33	69.16	61.66	7.50	14.67
Year	74.87	66.33	8.54	66.66	59.79	6.87	15.08

The mean range for the whole year was 15°.41.

TABLE XII.

SHOWING TABLE XI. FOR THE TEMPERATURE INDOORS WITHOUT FIRE.

Sta. Luzia, Funchal, Madeira, 1834-5.	Mean maximum in the day.	Mean minimum in the day.	Mean range.	Mean maximum in the night.	Mean minimum in the night.	Mean range.	Range of the 24 hours.
Winter.......	68°.00	61°.33	7°.33	63°.16	58°.00	5°.16	10°.00
Spring........	72.00	65.00	7.00	67.16	61.33	5.83	10.67
Summer	78.33	71.00	7.00	75.33	69.00	6.33	9.33
Autumn	75.33	68.00	7.00	71.66	65.33	6.33	10.00
Year	73.41	66.33	7.08	69.32	63.41	5.91	10.00

The mean range for the whole year indoors was 12°99.

Dr. Gourlay makes the mean annual temperature of Funchal, (average of 18 years)............	68°.89
Dr. Heberben makes the mean annual temperature of Funchal, corrected by Schouw............	67°.30
Dr. Heineken in 1826, register thermometer............	64°.56
Dr. Mason in 1834-5, register thermometer	66° 93
Mean deducted from the four observers............	66°.93
Mr. Kirwan makes the mean temperature of latitude 32°............	69°.1

TABLE XIII.

SHOWING THE RANGE BETWEEN THE MEAN EXTERNAL AND INDOOR TEMPERATURE FOR EACH MONTH.

Sta. Luzia, Funchal, Madeira, 1834-5.	Mean external temperature.	Mean internal temperature.	Mean range.
January	60°.24	60°.94	0°.70
February	61.12	61.83	0.71
March	63.43	65.23	1.80
April	65.39	66.46	1.07
May	67.97	68.95	0.98
June	69.44	70.83	1.39
July	71.68	74.14	2.46
August	72.78	74.46	1.68
September............	72.16	73.72	1.56
October	69.49	70.31	0.82
November............	65.45	65.89	0.44
December	64.25	65.14	0.89

TABLE XIV.

SHOWING THE DIFFERENCE BETWEEN THE MEAN EXTERNAL AND IN-DOOR TEMPERATURE FOR THE SEASONS AND FOR THE WHOLE YEAR.

Madeira, 1834-5.	Mean external.	Mean in-door.	Difference.
Winter	61°.87	62°.64	0°.77
Spring	65.59	66.88	1.29
Summer	71.30	73.14	1.84
Autumn	69.30	69.97	0.67
Year	66.95	68.16	1.21

TABLE XV.

SHOWING THE DIFFERENCE BETWEEN THE MEAN EXTERNAL TEMPERATURE OF EACH MONTH: AND BETWEEN THE MEAN TEMPERATURE OF EACH SEASON. STA. LUZIA, MADEIRA, 1834 AND 1835.

ANNUAL MEAN TEMPERATURE.	Difference of the mean temperature of winter and summer.	Difference of the mean temperature of the warmest and coldest month.	Mean difference of successive months.	Difference of successive Seasons.				Difference of successive Months.											
				Of winter and spring.	Of spring and summer.	Of summer and autumn.	Of autumn and winter.	Of January and February.	Of February and March.	Of March and April.	Of April and May.	Of May and June.	Of June and July.	Of July and August.	Of August and September.	Of Septem. and October.	Of October and November.	Of Novem. and December.	Of Decem. and January.
66°.95	9°.43	12°.54	2°.09	3°.72	5°.71	2°.00	7°.43	0°.88	2°.31	1°.96	2°.58	1°.47	2°.24	1°.10	0°.62	2°.67	4°.04	1°.20	4°.01

TABLE XVI.

SHOWING THE DIFFERENCE BETWEEN THE MEAN INDOOR TEMPERATURE OF EACH MONTH: AND BETWEEN THE MEAN TEMPERATURE OF EACH SEASON. STA. LUZIA, MADEIRA, 1834 AND 1835.

ANNUAL MEAN TEMPERATURE.	Difference of the mean temperature of winter and summer.	Difference of the mean temperature of the warmest and coldest month.	Mean difference of successive months.	Difference of successive Seasons.				Difference of successive Months.											
				Of winter and spring.	Of spring and summer.	Of summer and autumn.	Of autumn and winter.	Of January and February.	Of February and March.	Of March and April.	Of April and May.	Of May and June.	Of June and July.	Of July and August.	Of August and September.	Of Septem. and October.	Of October and November.	Of Novem. and December.	Of Decem. and January.
68°.16	10°.50	13°.52	2°.25	4°.24	6°.36	3°.71	7°.33	0°.89	3°.40	1°.23	2°.49	1°.88	3°.31	0°.32	0°.74	3°.41	4°.42	0°.75	4°.20
1°.21 +	1°.07 +	0°.98 +	0°.16 +	0°.52 +	0°.65 +	1°.71 +	0°.10 —	0°.01 +	1°.09 +	0°.73 —	0°.09 —	0°.41 +	1°.07 +	0°.78 —	0°.12 +	0°.74 +	0°.38 +	0°.45 —	0°.19 +

Difference in all these respects between the external and indoor temperatures.

TABLE XVII.

SHOWING THE MEAN DEGREE OF DRYNESS ON THE THERMOMETRIC SCALE OF FAHRENHEIT, BY DR. MASON'S HYGROMETER, AT THE HOURS INDICATED IN THE TABLE, FOR EACH MONTH, AND FOR THE WHOLE YEAR, AT STA. LUZIA, FUNCHAL, MADEIRA, INDEPENDENT OF *LESTE*.

Sta. Luzia, Funchal, Madeira, 1834-5.	6 a.m.	9 a.m.	Noon.	3 p.m.	6 p.m.	9 p.m.	Night.*
January	—	3.00°	3.51°	3.5°	3.0°	2.5°	1.76°
February	2.0°	3.92	4.84	5.33	4.07	3.17	2.94
March	4.6	3.5	4.72	5.0	6.0	4.5	4.5
April............	4.9	2.5	2.53	3.29	4.5	3.5	3.5
May	—	3.75	3.25	4.5	5 5	4.5	4.2
June	—	3.71	4.30	4.54	5.5	4.5	4.29
July	4.5	4.32	4.86	5 5	5.61	4.5	4.5
August.........	4.11	3.5	4.48	5.5	5.5	5.28	4.5
September ...	4.5	3.5	4.50	5.21	4.5	3.5	4.2
October.........	2.71	2.8	3.46	4.2	3.62	3.23	2.25
November ...	1.45	1.17	2.20	3.5	2.5	4 5	1.4
December ...	1.6	2.5	3.5	3.88	2.5	2.5	2.2
Year	3.16	3.18	3.84	4.49	4.40	3.84	3.35

* Different hours after 9 p.m.

TABLE XVIII.

SHOWING THE DIFFERENCE THE *LESTE*, OR DRY WIND, MAKES IN THE MEAN DRYNESS AT THE HOURS INDICATED IN THE TABLE.

Madeira, 1834-5, Sta. Luzia.	6 a.m	9 a.m.	Noon.	3 p.m.	6 p.m.	9. p m.	Night.
March	4.29°	—	5.86°	—	—	5.5°	—
June	—	3.86°	4.71	5.15°	6.5°	5.5	4.85°
October.........	3.37	3.14	—	—	—	—	—
December......	—	3.5	4.5	4.96	3.5	—	—

TABLE XIX.

SHOWING THE MEAN DEGREE OF DRYNESS ON THE THERMOMETRIC SCALE OF FAHRENHEIT BY DR. MASON'S HYGROMETER, AT THE VARIOUS HOURS INDICATED IN THE TABLE FOR EACH SEASON, AND FOR THE WHOLE YEAR.

Sta. Luzia, Madeira, 1834-5.	6 a.m.	9 a.m.	Noon.	3 p.m.	6 p.m.	9 p.m.	Night.
Winter	°1.80	°3.14	°3.95	°4.23	°3.19	°2.72	°2.30
Spring	3.80	3.25	3.50	4.26	5.33	4.16	4.06
Summer	4.30	3.84	4.54	5.18	5.53	4.76	4.43
Autumn	2.89	2.49	3.38	4.30	3.54	3.74	2.61
Year	3.19	3.18	3.84	4.49	4.40	3.84	3.35

TABLE XX.

SHOWING THE MEAN DEGREE OF DRYNESS ON THE THERMOMETRIC SCALE OF FAHRENHEIT, BY DR. MASON'S HYGROMETER, FOR EVERY MONTH IN THE YEAR FROM 9 A.M TO 9 P.M.; OBSERVATIONS MADE EVERY THREE HOURS.

Sta. Luzia, Funchal, Madeira, 1834-5.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Degrees of dryness. } ...	°3.10	°4.26	°4.55	°3.26	°4.10	°4.51	°4.95	°5.85	°4.21	°3.46	°2.17	°2.52
Calculated dryness.* } ...	7.2	9.9	10.6	7.6	9.6	10.5	11.6	13.2	9.6	8.1	4.9	5.8

TABLE XXI.

SHOWING THE MEAN MAXIMUM DRYNESS, BY DR. MASON'S HYGROMETER, FOR EVERY MONTH, FROM 9 A.M. TO 9 P M: OBSERVATIONS MADE EVERY THREE HOURS.

Sta Luzia, Funchal, Madeira, 1834-5.	January.	February,	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Degrees of dryness. } ...	°3.87	°5.26	°6.13	°4.63	°5.91	°5.85	°6.0	°6.05	°5.28	°4.15	°2.75	°3.25

* Dr. Mason has given the dryness, by his hygrometer—that is the *difference* between the temperature of a wet bulb and dry thermometer. The dryness in the second line has been calculated from a scale constructed by Dr. Mason—and described in the "Records of General Science," (vol. 4, pp. 23 and 96.) The mean dryness of the year was 3°.91 or calculated 9°.2.—[*See also Table XXXII., page* 198.]—Ed.

TABLE XXII.

SHOWING THE MEAN DRYNESS OF THE SEASONS, AND FOR THE WHOLE YEAR.

STA. LUZIA, FUNCHAL, MADEIRA, 1834-5.	Degrees of dryness.
Winter	3°.29
Spring	3.97
Summer	5.10
Autumn	3.28
Year	3.91

TABLE XXIII.

SHOWING THE MEAN MAXIMUM DRYNESS FOR THE SEASON, AND FOR THE WHOLE YEAR.

STA. LUZIA, FUNCHAL, MADEIRA, 1834-5.	Degrees of dryness.
Winter	4°.13
Spring	5.56
Summer	5.96
Autumn	4.60
Year	5.05

TABLE XXIV.

SHOWING THE MAXIMUM AND MINIMUM DRYNESS INDICATED BY DR. MASON'S HYGROMETER FOR EVERY MONTH IN THE YEAR, INDEPENDENT OF *LESTE.*

STA. LUZIA, FUNCHAL, MADEIRA, 1834-5.	Maximum dryness.	Minimum dryness.
January	6°	0°
February	7	1
March	8	1
April	8	0
May	9	0
June	9	2
July	9	2
August	8	3
September	7	1
October	6	0
November	6	0
December	7	0

TABLE XXV.

SHOWING THE MAXIMUM DRYNESS IN EACH MONTH WHEN THE *LESTE,* OR DRY WIND OCCURRED.

MADEIRA, 1834-5.	Maximum dryness.
January	9°
February	9
March	14
June	15
October	22.5
December	13

TABLE XXVI.

CONTAINING AN EXTRACT FROM DR. MASON'S JOURNAL, SHOWING THE DIFFERENCE BETWEEN THE STRONGEST *LESTE* WHICH OCCURRED DURING HIS RESIDENCE, IN MADEIRA, AND THE ORDINARY STATE OF THE ATMOSPHERE, IN THE SAME MONTH.

[In this table, all the instruments, except the thermometer in the shade, were exposed in the garden, to the full influence of sun, wind, and all the sources of reflected and radiant heat.]

Day of Month.	Hour of observation.	Temperature in the shade.	Black-wooled thermometer on the ground.	Naked thermometer in the air.	Thermometer, with moistened bulb covered with silk.	Difference, or degrees of dryness on the thermometric scale.	Remarks.
OCTOBER.		°	°	°	°	°	
Monday, 20th.	10 a.m.	70	70	73	69	4	N., dull, calm.
	11 a.m.	74	71	78	71	7	N., more clear.
	Noon.	74	90	77	71	6	S.W., calm and cloudy.
	3 p.m.	74	122	83	76	7	S.W., calm and fine (clear).
	5 p.m.	73	78	74	71	3	N.N.W., rather cloudy, calm.
	6 p.m.	72	72	72	70	2	N.N.W., more cloudy, slight rain.
	8 p.m.	71	68	70	68	2	Very cloudy and dark, strong deposit of dew on the thermometer on the ground.
	10 p.m.	70	66	69	68	1	Cloudy, moon bright, strong deposit of dew.
Tuesday, 21st.	6 a.m.	69	65	69	68	1	N.E., clear, moon bright, strong deposit of dew.
	8 a.m.	69	70	72	67	5	N.E., high clouds from sea to land.
Wednesday, 22nd.	9 a.m.	73	100	85	65	20	E., clear, calm, *Leste.*
	10 a.m.	75	122	88	67	21	E., ditto, ditto, ditto.
	11 a.m.	76	138	93	69	24	E., clear, wind strong.
	Noon.	76	137	95	69	26	E., clear, wind very strong.
	2 p.m.	81	130	96	73	23	E., clear, wind moderate.
	3 p.m.	81	124	96	72	24	E., clear, wind increasing.
	4 p.m.	81	110	93	74	19	E., clear, moderate breeze.
	5 p.m.	80	90	86	68	18	E., ditto ditto.
	6 p.m.	78	70	86	69	17	E., clear evening, star-bright, wind moderate.
	8 p.m.	77	70	80	64	16	E., clear, stars very bright, wind moderate.
	10 p.m.	76	65	75	61	14	Clear, stars very bright, no deposit of dew; wind E.
Thursday, 23rd.	7 a.m.	75	70	80	60	20	Clear, rather hazy over the sea; wind strong, wind E.
	9 a.m.	75	80*	83	63	20	Clear, rather hazy over sea; wind strong. * Not in the sun. Wind S.E.
	Noon.	79	139	90	69	21	Ground quite parched, W.S.W., calm, the *Leste* abated about 4 p.m.
	3 p.m.	80	110	89	72	17	During the night the chairs and furniture cracked very much.
	6 p.m.	76	70	74	67	7	Wind rather strong.
	8 p.m.	74	64	71	64	7	Wind strong; strong deposit of dew on the glass-case of the thermometer; clear and starlight.
Friday, 24th.	7 a.m.	70	64	69	67	2	Night fine, very strong deposit of dew on the thermometer on the ground; plants and ground quite moist.
	9 a.m	71	73	73	70	3	Calm but cloudy.
	Noon.	73	100	75	70	5	S.W., very cloudy; rain on the mountains.
	2 p.m.	73	90	76	72	4	Ditto, ditto.
	3 p.m.	73	88	76	72	4	Ditto, ditto.
	5 p.m.	73	78	72	68	4	Ditto, ditto, but more clear over the mountains.
	6 p.m.	72	72	70	67	3	Ditto; cloudy and dull.
	10 p.m.	70	70	67	65	2	Calm; stars bright; some clouds.
Tuesday, 28th.	8 a.m.	65	57	62	60	2	N.E., fine; few clouds.
	9 a.m.	66	110	68	63	5	N.E., fine, no clouds over the valley.
	11 a.m.	67	130	77	72	5	S.W., fine; calm; ditto.
	Noon.	69	136	77	71	6	S.W., ditto; ditto.
	2 p.m.	70	110	80	73	7	S.W., few clouds over the valley.
	3 p.m.	71	110	80	73	7	S.W., ditto; wind strong.
	5 p.m.	71	75	72	68	4	Rather cloudy.
	6 p.m.	69	68	68	65	3	Ditto ditto.
	10 p.m.	67	60	64	61	3	Stars bright; strong deposit of dew.

TABLE XXVII.

SHOWING THE DRYNESS FOR THE SEASONS, AND FOR THE WHOLE YEAR CALCULATED FROM DR. HEINEKEN'S OBSERVATIONS IN FUNCHAL, MADEIRA. ONE OBSERVATION A DAY, AT 10 A.M.—DANIEL'S HYGROMETER.

FUNCHAL, MADEIRA, 1826.	Winter.	Spring.	Summer.	Autumn.	Year.
Mean temperature in the shade for the seasons	62°.50	65°.33	73°.17	71°.50	68°.12
Mean dewpoint	54.14	55.00	66.64	67.05	60.70
Mean degree of dryness on the thermometric scale	8.36	10.33	6.53	4.45	7.42
Mean elasticity of the vapour at the temperature of the air	0.599	0.661	0.854	0.808	0.730
Mean elasticity of vapour at the temperature of the dewpoint	0.462	0.476	0.691	0.699	0.582
Mean degree of moisture on the hygrometric scale, saturation being 1.000	.771	.720	.809	.865	.791
Actual quantity of vapour the mean temperature would support, if saturated, per cubic foot in grains	6.584	7.301	9.247	8.791	7.980
Weight of vapour per cubic foot in grains actually existing in the atmosphere; deduced from the hygrometer	5.115	5.234	7.488	7.603	6.360
Difference or quantity required for saturation	1.469	2.067	1.759	1.188	1.620
Evaporation per minute from a round vessel, six inches in diameter, moderate breeze, supposing the air free from vapour, in grains	.72	.94	.90	.50	.76

TABLE XXVIII.

SHOWING THE MEAN DRYNESS, ETC., FOR THE SEASONS, AND FOR THE WHOLE YEAR; CALCULATED FROM PROFESSOR DANIEL'S OBSERVATIONS ON THE CLIMATE OF LONDON.

London.	Winter.	Spring.	Summer.	Autumn.	Year.
Mean temperature of the air in the shade for the seasons..........	37°.7	49°.2	60°.4	49°.8	49°.2
Mean dewpoint	35.6	42.8	53.5	45.8	44.4
Mean degree of dryness on the thermometric scale	2.1	6.4	6.9	4.0	4.8
Mean elasticity of vapour at the temperature of the air............	0.261	0.395	0.534	0.408	0.399
Mean elasticity of vapour at the temperature of the dewpoint ...	0.245	0.316	0.456	0.351	0.341
Mean degree of moisture on the hygrometric scale, saturation being 1,000°..........................	.932	.794	.797	.869	.848
Actual quantity of vapour the mean temperature would support if saturated, per cubic foot in grains............................	3.040	5.481	6.299	4.625	4.861
Weight of vapour, in a cubic foot in grains, actually existing in the atmosphere, deduced from the hygrometer....................	2.943	3.579	5.026	3.984	3.883
Difference or quantity required for saturation	0.097	1.902	1.273	0.641	0.978
Evaporation per minute from a round vessel, 6 inches in diameter, moderate breeze, supposing the air free from vapour, in grains	.10	.40	.61	.30	.35

TABLE XXIX.

SHOWING THE MAXIMUM AND MINIMUM DRYNESS OF THE MONTH, WITH THE MEAN DRYNESS AT THE HOURS INDICATED IN THE TABLE; ALSO THE MEAN MONTHLY DRYNESS FROM 9 A.M. TO 9 P.M. MRS. MAIR'S LODGINGS, FUNCHAL, MADEIRA, SITUATE 40 FEET ABOVE THE SEA, AND 400 YARDS DISTANT.

MADEIRA, 1835. MRS. MAIR'S LODGINGS.	6 a.m.	9 a.m.	Noon.	3 p.m.	6 p.m.	9 p.m.	Night.	Mean dryness from 9 a.m. to 9 p.m.	Maximum dryness.	Minimum dryness.
March	3.5°	5.0°	5.82°	5.5°	5.03°	4.88°	4.54°	5.25°	9°	2°
April	3.01	4.44	5.47	5.52	4.16	3.5	3.62	4.62	9	0
May, from the 1st to the 8th	3.33	5.5	5.4	4.4	4.2	4.7	4.7	4.48	9	3

TABLE XXX.

SHOWING THE MEAN DRYNESS AT THE HOURS INDICATED IN THE TABLE; WITH THE MEAN OF TWENTY-EIGHT OBSERVATIONS MADE FROM 9 A.M. TO 9 P.M. THESE OBSERVATIONS WERE MADE AT MASON'S HOTEL, PONTA DELGADA, ST. MICHAEL'S, NEAR THE SEA, ON THE 14TH OF MAY, AND THE THREE FOLLOWING DAYS; ALSO ON THE 22D, AND THE THREE FOLLOWING DAYS, WITH THE MAXIMUM AND MINIMUM DRYNESS OBSERVED DURING THE ABOVE PERIOD.

1835. ST. MICHAEL'S.	6 a.m.	9 a.m.	Noon.	3 p.m.	6 p.m.	9 p.m.	Night.	Mean from 9 a.m. to 9 p.m.	Maximum dryness.	Minimum dryness.
Eight days in May.	4.0°	5.0°	6.83°	5.6°	5.0°	4.2°	4.0°	5.33°	8°	3°

TABLE XXXI.

SHOWING THE MEAN DRYNESS AT THE HOURS INDICATED IN THE TABLE; WITH THE MEAN OF FIFTEEN OBSERVATIONS MADE FROM 9 A.M. TO 9 P.M.; ALSO, THE MAXIMUM AND MINIMUM DRYNESS, OBSERVED. THESE OBSERVATIONS WERE MADE IN A ROOM ON THE GROUND FLOOR, AT MASON'S HOUSE, IN THE VALLEY OF THE FURNAS, SITUATE ABOUT 2,000 FEET ABOVE THE SEA, AND FROM FOUR TO FIVE MILES DISTANT, ON THE 17TH, 18TH, 19TH, AND 20TH OF MAY, 1835.

1835, ST. MICHAEL'S.	6 a.m.	9 a.m.	Noon.	3 p.m.	6 p.m.	9 p.m.	Night.	Mean from 9 a.m. to 9 p.m.	Maximum dryness.	Minimum dryness.
Four days in May..	1.0°	1.0°	2.0°	1.43°	1.33°	1.66°	1.75°	1.48°	3°	0°

TABLE XXXII.

SHOWING THE EQUIVALENT INDICATIONS OF SIR JOHN LESLIE'S AND THE DEWPOINT HYGROMETERS, CORRESPONDING TO EVERY DEGREE OF MASON'S HYGROMETER.

MASON'S HYGROMETER.	DEWPOINT HYGROMETER.	LESLIE'S HYGROMETER.
Degrees of dryness observed.	Degrees of dryness.	Degrees of dryness.
0	0.0	0
0.5	1.166	3
1	2.332	6
1.5	3.499	9
2	4.666	12
2.5	5.833	15
3	7.0	18
3.5	8.166	21
4	9.332	24
4.5	10.499	27
5	11.666	30
5.5	12.833	33
6	14.0	36
6.5	15.166	39
7	16.332	42
7.5	17.499	45
8	18.666	48
8.5	19.833	51
9	21.0	54
9.5	22.166	57
10	23.332	60
10.5	24.499	63
11	25.666	66
11.5	26.833	69
12	28.0	72
12.5	29.166	75
13	30.332	78
13.5	31.492	81
14	32.666	84
14.5	33.833	87
15	35.0	90
15.5	36.166	93
16	37.332	96
16.5	38.499	99
17	39.666	102
17.5	40.833	105
18	42.0	108
18.5	43.166	111
19	44.332	114
19.5	45.499	117
20	46.666	120
20.5	47.833	123
21	49.0	126
21.5	50.166	129
22	51.332	132
22.5	52.499	135

CHAPTER XV.

METEOROLOGICAL OBSERVATIONS—1848 AND 1849.

Charles McEuen, Esquire, of Philadelphia, who was a visitor at Madeira, during the past winter, has kindly placed at the disposal of the editor, the following valuable paper; which is rendered the more interesting from the more recent dates at which the observations were made; and from the decided bearing which his conclusions have upon those of Dr. Mason. I would suggest, that if visitors to Madeira would employ a part of their leisure in recording the state of the weather, much of the difference of opinion, now existing, as to the advantages or disadvantages of its climate, in certain cases of disease would disappear.

It is singular that in an Island, so celebrated for its salubrity, no regular meteorological records should be kept, or, at least, published; and that such difference of opinion should exist, as to certain features in the climate. Dr. Mason most justly remarks that the memory of the "oldest inhabitant" is little to be depended on, if not supported

by written and recorded observations; and it strikes me that the medical practitioners, resident in the Island, can hardly allow the subject to be longer neglected, in the present advanced state of science; without subjecting themselves to the reproach of indifference, relative to the charge, sometimes urged against them, of withholding the truth, under a dread that the far-famed climate of the Island will not bear the test of close and accurate examination.

The *mean temperature* is perhaps sufficiently well determined by the observations of Drs. Heineken, Gourlay, and Renton. The variation, from one day to another, I think, requires further investigation. The *force* of the wind—which I found a source of serious objection to the climate—should be observed by the anemometer; and *hygrometrical* observations—now so easily made with the *wet thermometer*—should never be neglected.

If I found the climate to fall short of the exaggerated descriptions of many writers, still I cannot see how it is possible for any reasonable person to speak of it in the disparaging terms of some visitors, soured, perhaps, by disappointed hopes of improved health, or deceived by those who are interested in representing it as a perfect paradise.

I would advise invalid visitors to see that the apartments they purpose occupying for the winter, have fire-places or stoves, by which they can be warmed and dried in bad weather; as the tempe-

rature, in-doors, is frequently too low for comfort or health.

METEOROLOGICAL REGISTER, KEPT AT FUNCHAL, MADEIRA, FROM THE 10*th DECEMBER*, 1848, *TO THE* 1*st JUNE*, 1849, *BY CHARLES McEUEN*, *Esq.*

"These observations were made at Mr. Hollway's Boarding-house, about half a mile N. E. of the city, and 280 feet above the level of the sea.

The *Self-registering thermometers* were placed under the veranda, on the North side of the house, seven feet above the ground; open to the North, and with blinds to the East and West, but sheltered by a roof from the sky.

The *Barometric observations* were made in-doors, by an *Aneroid*, which I have found to correspond with a mercurial barometer.

The *Hygrometrical observations*—to which I attach the most importance, inasmuch as the degree of moisture at Madeira is a constant subject of dispute, and has been but little studied—were made with great care, and, I think, may be fully relied on.

A *Mason's Hygrometer*, procured in London, was accidentally broken soon after my arrival in Madeira. Fortunately, I had a very slender thermometer with a detached bulb, made by Fisher of Philadelphia, which had been compared by a standard made for the Girard College Observatory, by Greiner of Berlin, and found to be remarkably accurate. This thermometer was suspended in the

open air, ten inches outside the second story North-window of the cottage, across the road from Mr. Hollway's, and observed first *dry*, and immediately afterwards *wet*, the glass and inner shutter being always closed some minutes before the observations, which were made at the hours mentioned in the tables. Nine a.m. was chosen as giving *nearly* the mean of the twenty-four hours, and the afternoon observation was made *nearly* at the hour of maximum temperature, which is also usually that of greatest dryness.

In the Tables—

The 1st	column,	t,	shows the	*Dry* thermometer.
2nd	,,	t^*	,,	*Wet* thermometer.
3rd	,,	d	,,	The difference.
4th	,,	t^{**}	,,	The dewpoint corresponding, deduced from the tables published by "Kupffer, St. Petersburgh, 1841, for the use of the Russian observatories."
5th	,,	e	,,	Elastic force of the vapour, corresponding in tenths of an inch.
6th	,,		,,	Relative moisture, or per cent. of vapour in the atmosphere; saturation for the existing temperature being considered 100.

The numbers in the last column are also taken from "Kupffer's Tables," which will be found exceedingly convenient, and may be procured from Jones, optician, Charing Cross, London. Kupffer's Tables are adapted to Reaumer's thermometer; but, by marking the corresponding degrees of Fahrenheit along the margin, it is easy to use them for that scale.

It will be seen that my observations show a much greater degree of dryness than Dr. Mason's.

MEAN DIFFERENCE BETWEEN DRY AND WET THERMOMETERS, AT 9 A.M.

	Dec.	Jan.	Feb.	March.	April.	May.
	°	°	°	°	°	°
By Dr Mason............	2.5	3 0	3 9	3 5	2.5	3.7
By Mr. McEuen.........	4 8	6 0	6.4	9 1	6 4	6.8
Difference................	2.3	3.0	2.5	5 6	3.9	3.1

The difference of locality, or the circumstance of his observations having been made in the house, with open windows, and mine out of doors, does not sufficiently explain the discrepancy, which, I think, fully proves—what Dr. Mason suspected—that the different years vary much more than is generally admitted.

The difficulty of ascertaining the direction of the wind, renders my observations on that subject of scarcely any value; each locality being differently influenced by the vicinity of the mountains. I have made use of the following abbreviations for the force of the wind: O, calm—1, light or moderate—2, fresh—3, strong or violent; for the state of the sky—B, blue or clear—C, cloudy—R, rain—S, showers—O, overcast—T, threatening—F, foggy—H, hazy. A dot under a letter shows a preponderance of the state; indicated by the letter, as B. C., blue sky, with some clouds.

My observations will show that the extraordinary dry wind, *Leste*, prevailed twice in February, and twice in March. On the 17th February, there was a difference of 21 *degrees* between the dry and wet thermometers!—showing only 18 per cent. of moisture in the atmosphere. Baron Humboldt

speaks of 16 per cent. vapour, as being the greatest dryness ever observed in the lower regions of the atmosphere; and that, in the interior of a vast continent. When we consider that this dry wind at Madeira, must have passed over nearly 300 miles of sea, it is certainly a most remarkable phenomenon; and its effects on invalids—if carefully observed and studied—would furnish valuable data for estimating the fitness of the climate, in a normal state, as a resort for many cases of disease."

TABLE XXXIII.

December 1848—Nine o'clock, a.m.

1848.	Thermometer.			Barometer.	Hygrometer.		
December.	Minimum.	Maximum.	Mean.	Aneroid.	t	d	t_*
	°	°	°	In.	°	°	°
11	66	70.5	68.2	29.94	69.5	4.5	65
12	64	70	67	30	67	3	64
13	64	69	66.5	29.95	68	3	65
14	66	69	67	29.85	67	2	65
15	65	69	67	29.83	68	7.5	60.5
16	57	68	62.5	29.86	60.5	6.5	54
17	55.5	64.5	60	29.96	57.5	7	50.5
18	59	67.5	63.5	29.85	58	0	58
19	57	64	60.5	30.03	60	8	52
20	57.5	67	62.2	29.96	61	7	54
21	56	65	61.5	29.79	61	8	53
22	55	64.5	59.7	29.74	60	—	—
23	56	66	61	29.75	60	4	56
24	58	65.5	61.7	29.79	62	0	62
25	63	67	65	29.96	65	2	63
26	62	69	65.5	30	66	3	63
27	61	69.5	64.5	30.02	64.5	5.5	59
28	64	67	65.5	29.95	65	11	54
29	64.5	67	65.7	29.66	66	4	62
30	57	65	61	29.65	60	8	52
31	61	63	62	29.31	63	0	63
Mean.	60.4	67.0	63.7	29.85	63.3	4.7	58.7

TABLE XXXIV.

December, 1848.

1848.	Hygrometer, 9 a.m.			Hygrometer, half-past 1 p.m.				
December.	Relative moisture.	Sky.	Wind.	t	$t*$	Relative moisture.	Sky.	Wind.
11	79	H.O.	S.W. 0	70°	66°	81	C.H.	S. b. W. 1
12	85	C.O.	S. 1	68	64	80	C.H.	N.W. 2
13	83	C.B.	S. b. E. 1	69	66	86	C.T.	S.W. 2
14	86	O.C.T.	S.W. 2	70	64	72	C.T.	S.W. 2
15	64	C.B.	S. b. W. -	69	62	67	C.	S.W. 3
16	65	B.	— 0	66	59	66	B.C.	N.E. 1
17	61	B.	N. 0	62.5	54	56	B.C.	N.W. 2
18	100	O.R.	— -	68	63	76	B.C.	S.W. 0
19	57	B.	— 0	62	54	58	C.B.	E. b. S. 1
20	63	B.C.	— 0	66	56	53	C.	— 0
21	57	B.C.	— 0	62	56	68	O.T.	W. 2
22	—	B.C.	— 0	66	58	62	B.C.	E. 1
23	78	B.	W. 0	64	59	75	B.	S.W. 0
24	100	O.R.	S.W. 2	65	63	89	R.	S.W. 2
25	89	C.	S.W. 2	67	61	71	B.C.	S.W. 1
26	85	B.C.	— 0	69	62	67	B.C.	S.E. 0
27	72	C.	S.E. 0	70	64	72	B.C.H.	S.E. 1
28	47	O.	N.E. 1	68	55	41	O.	N.E. 1
29	79	O.	N. 0	65	59	70	C.B.	N.E. 1
30	57	B.C.	— 0	65	56	56	B.C.	N.W. 1
31	100	R.	S.E. 3	62	62	100	R.R.	S. b. W. 3
Mean.	75			66.4	60	70		1.3

TABLE XXXV.

January, 1849.

1849. January.	Thermometer. Minimum.	Thermometer. Maximum.	Thermometer. Range.	Thermometer. Mean.	Barometer. 9 a.m.	Barometer. 4 p.m.
	°	°	°	°	In.	In.
1	61	67	6.0	64.0	29.17	29.13
2	59	66.5	7.5	62.7	.30	.34
3	57	68.5	11.5	62.7	.60	.60
4	56	66.5	10.5	61.2	.76	.76
5	56.5	67	10.5	61.7	.80	.70
6	61	69.5	8.5	65.2	.64	.60
7	61	68	7.5	64.5	.66	.75
8	62	67	5 0	64.5	30.06	30.08
9	53.5	67	13.5	60.2	.15	.10
10	56	67	11	61.5	.05	.00
11	59	67.5	8.5	63.2	.04	.04
12	58	64.5	6.5	61.2	.14	.10
13	55	66	11	60.5	.10	.12
14	54	69.5	15.5	61.7	.20	.18
15	55	70.5	15.5	62.7	.16	.10
16	53	67	14	60	.10	.04
17	53	65	12	59	.06	.03
18	55	67	12	61	.00	.95
19	56	67	11	61.5	.00	.00
20	56	67	11	61.5	.14	.08
21	56	69	13	62.5	.26	.15
22	55.5	66.5	11	61	.24	.20
23	56.5	68	11.5	62.2	.25	.18
24	58	67	9	62.5	.15	.06
25	58	65	7	61.5	.12	.08
26	56	64	8	60	.16	.09
27	55	67	12	61	.11	.06
28	56	66	10	61	.10	.05
29	54	65.5	11.5	59.7	.10	.15
30	55	66	10.5	60.7	.17	.14
31	55	67	12	61	.17	.12
Mean.	56.6	67	10.4	61.7	29.99	29.96

TABLE XXXVI.

February, 1849.

1849.	Thermometer.				Barometer.	
February.	Minimum.	Maximum.	Range.	Mean.	9 a.m.	4 p.m.
					In.	In.
1	55°	68°	13°	61.5°	30.10	30.05
2	53	65.5	12.5	59.2	.03	29.96
3	53	67	14	60	29.96	.93
4	55	68	13	61.5	30.01	.96
5	55	69	14	62	.01	.95
6	59	69.5	10	64.2	29.92	.00
7	57	72	15	64.5	30.05	30.03
8	62	73	11	67.5	30.13	.10
9	57.5	68	10	62.7	.09	.00
10	57.5	68	10	62.7	.00	29.95
11	56	65	9	65	29.94	.87
12	59	67	8	63	.84	.85
13	56.5	68.5	12.5	63	.95	.89
14	57	72	15	64.5	.91	.83
15	59	71.5	11.5	64.7	.93	.95
16	67	70	3	68.5	30.14	30.11
17	68.5	73	4.5	77	.11	.07
18	56	69	13	62.5	.14	.10
19	54	68	14	61	.15	.13
20	56	69	13	62.5	.15	.10
21	55	65.5	10.5	60.2	.09	.01
22	54	69.5	15.5	61.7	29.96	29.88
23	54	68	14	61	.95	.90
24	54	68	14	61	.94	.90
25	54	68.5	14.5	61.2	.94	.92
26	57	64	7	60.5	30.03	30.00
27	53	62.5	9.5	57.7	.10	.08
28	55	63	8.0	59	.13	.06
Mean.	56.8	68.2	11.4	62.5	30.02	29.98

TABLE XXXVII.

March, 1849.

1849.	THERMOMETER.				BAROMETER.	
March.	Minimum.	Maximum.	Range.	Mean.	9 a m.	4 p.m.
					In.	In.
1	52°.5	70°	17°	61°	30.10	30.06
2	54.5	68	13.5	61.2	.06	.07
3	55	74	19.0	64.5	29.91	29.78
4	61	75	14	68	.82	.82
5	64	75	11	69.5	.95	.93
6	66	74	8	70	.96	.91
7	66	71	5	68.5	.95	.88
8	60	70	10	65	.80	.77
9	60	70	10	65	.80	.73
10	58	69.5	11.5	63.7	.82	.83
11	55	67	12	61	.99	30.02
12	54	64.5	10.5	59.7	30.16	.18
13	53	65	12	59	.15	.06
14	55	66	15	60.5	.03	29.95
15	57.5	68	10.5	62.7	29.93	.93
16	59.5	68.5	9	64	30.01	.99
17	60	73	13	66.5	.10	30.02
18	59.5	69	10	64.5	.19	.06
19	57	70	13	63.5	.10	.03
20	57	70	13	63.5	.00	29.90
21	—	—	—	—	29.65	.62
22	—	—	—	—	.69	.63
23	53	61	8	57	.53	.44
24	—	62	—	—	.34	.33
25	—	—	—	—	—	—
26	—	—	—	—	—	29.55
27	—	—	—	—	—	.86
28	—	—	—	—	—	—
29	—	—	—	—	—	—
30	—	—	—	—	—	—
31	—	—	—	—	—	—
Mean.	57.2	69.3	11.8	63.5	29.92	29.86

TABLE XXXVIII.

April, 1849.

1849.	THERMOMETER.				BAROMETER.	
April.	Minimum.	Maximum.	Range.	Mean.	9 a.m.	4 p.m.
					In.	In.
1	—	—	—	—	—	29.99
2	—	—	—	—	29.87	.83
3	—	—	—	—	.82	—
4	56°	59°	3°	57.5°	.92	—
5	56	68	13	62.5	.89	.80
6	55	68	13	61.5	.75	.66
7	58	70	12	64	.75	.73
8	56	74	18	65	.75	.70
9	57	74	7	60.5	.75	.73
10	57	70	13	63.5	.70	—
11	57	69	12	63	.77	.76
12	57	65	8	61	.81	.80
13	57.5	65	7.5	61.2	.73	.70
14	57	73	16	65	.75	.71
15	58	66	8	62	.66	.60
16	58	66	8	62	.55	.50
17	61.5	68	6.5	64.7	.50	.48
18	58.5	66.5	8	62.5	.66	.70
19	60	66	6	63	.81	.84
20	57	64	7	60.5	.91	.88
21	57	64	7	60.5	.81	.73
22	55.5	65	9.5	60.2	.81	.81
23	54.5	66.5	12	60.5	.84	—
24	56.5	65	9.5	61.2	.80	—
25	57	65.5	8.5	61.2	.83	.83
26	58	69	11	63.5	.92	.93
27	58.5	69	10.5	63.7	30.02	30.03
28	60	72	12	66	.05	.02
29	—	70.5	—	—	.00	29.86
30	59	69.5	8.5	63.2	29.94	.87
Mean.	57.4	67.6	10.2	62.3	29.80	29.78

TABLE XXXIX.

MAY, 1849.

1849.	THERMOMETER.				BAROMETER.	
May.	Minimum.	Maximum.	Range.	Mean.	9 a.m.	4 p m.
1	57°.0	63°	6°	60°	In. 29.50	In. 29.65
2	54	68	14	61	.69	.76
3	58	68.5	10.5	63.2	.62	.59
4	57	69.5	12.5	63.2	.60	.57
5	58	68 5	10	63.5	.58	.58
6	58	69.5	11 5	63.7	.62	.65
7	58	69	11	63	.75	.79
8	58	69	11	63.5	.92	.95
9	59	70	11	64	.96	.95
10	61	72	11	66	.94	.93
11	61	78	17	69.5	.93	.90
12	63	74	11	68.5	.93	.92
13	63	73.5	10.5	68.2	.95	.94
14	61	70	9	65.5	.93	.86
15	—	68	—	—	.79	.74
16	—	71	—	—	.75	.74
17	63	70	7	66.5	.87	.89
18	60	68	8	64	.94	.92
19	59	71	12	65	.84	.80
20	59	73	14	66	.79	.77
21	59	70	11	64.5	.80	.82
22	60	77	17	68	.83	.78
23	59	—	—	—	—	—
24	60	70	10	65	.72	.69
25	63	77	14	70	.65	.63
26	61	72	11	66.5	.64	—
27	62	72	10	67	.77	.76
28	63	68	5	65.5	.90	.89
29	59	68	9	63.2	.90	.86
30	61	72	10.5	66.7	.79	.74
31	62	72	10	67.0	.72	.70
Mean.	59.9	70.7	10.9	65.3	29.75	29.78

TABLE XI.

January, 1849.

1849.	Hygrometer, 9 A.M.						Sky.	Wind.	
January.	t	t*	d	t**	e	Relative moisture.			
	°	°	°	°	In.	°			
1	64.0	62	2	61	5.21	89	B.C.H.	S.E.	1
2	65	60	5	57	4.51	75	B.C.S.	S.W.	3
3	61	57	4	54	4.08	78	B.	W.	0
4	60	55	5	51	3.69	73	B.H	N.	0
5	62	56	6	51	3.70	68	B.C.	—	-
6	65	62	3	60.5	5.11	85	B.C.	—	-
7	64	59	5	55.5	4.31	75	B.C.	N.	2
8	60	56	4	53	3.93	78	B.	—	0
9	59	52	7	45.5	3.01	62	B.	—	0
10	60	58	2	57	4.50	88	B.	E.	-
11	63	58	5	54.5	4.16	75	B.C.	—	-
12	62	53	9	44.5	2.91	53	B.C.	N.E.	2
13	64	52	12	40	2.15	42	B.	N.	2
14	60	53	7	46.5	3.14	62	B.	—	-
15	60	54	6	49	3.41	67	B.	N.E.	2
16	58	54	4	51	3.64	77	B	—	-
17	57	54	3	52	3.77	83	B.	—	-
18	60	55	5	51	3.66	73	B.C.	—	-
19	61	56	5	52	3.82	73	B.C.	—	-
20	62	56	6	51	3.70	68	B.C.	—	-
21	64	56	8	49.5	3.46	59	B.C.	N.E.	2
22	58	54	4	50.5	3 64	77	—	—	-
23	60	54	6	49	3 41	67	C.B.	—	1
24	61	53	8	45.5	3.00	57	B.	N E.	2
25	64	53	11	50.5	3.64	77	B.C.	N.E	1
26	58	57	1	56	4.41	93	O.S.	—	-
27	60	53	7	46.5	3 13	62	B.	—	-
28	61	56	5	52	3.82	73	B.C.	—	-
29	60	54	6	49	3.41	67	B.C.	N.E.	2
30	60	54	6	52	3.77	83	C.B.	N.E.	1
31	58	54	4	51	3.64	77	B.C.	—	-
Mean.	61	55	6	51.2	3.74	72		0.7.	

TABLE XLI.

January, 1849.

1849.	Hygrometer, 2 p.m.						Sky.	Wind.	
January.	t	t^*	d	t^{**}	e	Relative moisture.			
	°	°	°	°	In.				
1	60	58	2.0	57	4.50	88	O.T.R.	S.W.	2
2	66	60	6	56	4.35	70	B.C.	S.W.	3
3	65	58	7	53	3.93	66	B.C.	S.W.	2
4	68	60	8	54.5	4.14	62	B.	N.E.	1
5	65	62	3	60	5.11	85	B.C.	S.W.	2
6	66	63	3	61	5.28	85	B.C.S.	E.	0
7	66	60	6	56	4 39	71	B.C.	N.	2
8	68	61	7	56.5	4.44	67	B.C.	S.	1
9	66	61.5	4.5	58.5	4.80	77	B.C.H.	S.	1
10	66	63.5	2.5	62	5 42	87	C.B.	S.	1
11	66	60	6	56	4.35	70	B.C	N.W.	1
12	64	56	8	49.5	3 45	59	B.C.	N.E.	2
13	66	56	10	47 5	3.26	53	B.	N.E.	2
14	68	60	8	54.5	4.16	62	B.	S.E.	2
15	67	58	9	51	3.70	57	B.	E.	2
16	66	60	6	56	4.39	71	B.	S.E.	1
17	65	58	7	53	3.92	66	C.	—	0
18	68	62	6	58	4.71	71	B.C.	S.E.	1
19	63	57	6	52.5	3.85	69	C.O.	E.	1
20	66	60	6	56	4.35	70	B.C.	N.E.	1
21	66.5	58	8.5	51.5	3.75	59	B.	S.E.	1
22	65	58	7	53	3.92	65	B.C.	S.E.	1
23	68	58	10	50.5	3.60	54	B.C.	N.E.	1
24	67	58	9	51	3.70	57	B.C.	N.E.	2
25	62	58	4	55.5	4.27	78	C.O.S.	S.E.	2
26	66	56	10	47.5	3.26	53	C B.	S.E.	1
27	66	57	9	53.5	4.03	76	B.C.	N.E.	2
28	65	60	5	56 5	4.45	75	B.C.	N.	1
29	66	58	8	52	3.80	61	B.C.	N.E.	2
30	64	57.5	6.5	52.5	3.87	67	C.B.	N.E.	4
31	68	60	8	54.5	4.18	62	B.C.	N.E.	2
Mean.	65.8	5.91	6 6	51.4	4.16	68			1.4

TABLE XLII.

February, 1849.

1849.	Hygrometer, 9 A.M.						Sky.	Wind.	
February.	t	t^*	d	t^{**}	e	Relative moisture.			
1	59°	56°	3°	54°	4.06	83	B.C.	—	0
2	58	54	4	51	3.64	77	B.	—	0
3	58	55	3	53	3.93	83	B.	—	0
4	60	54	6	49	3.41	67	B.	—	-
5	61	55	6	50	3.55	67	B.	—	0
6	64	60	4	57.5	4.60	79	B.C.H.	—	0
7	64	52	12	40	2.45	42	B.C.	—	0
8	66	51	15	34	1.95	31	B.	—	0
9	62	54	8	47	3 16	58	B.C.	N.	1
10	62	55	7	49.5	3.46	63	B.C.	N.E.	2
11	56	56	0	56	4.37	100	O.R.	N.E.	2
12	64	62	2	61	5.19	89	O.H.S.	N.E.	-
13	62	57	5	53.5	3.98	74	B.H.	E.	-
14	61	56	5	52	3.82	73	B.H.	—	-
15	67	59	8	53.5	3.98	62	B.H.	S.E.	2
16	68	58	10	50	3.58	54	O.T.	—	0
17	69	54	15	39	2.37	35	B.H.C.	N.E.	3
18	60	54	6	49	3.41	67	B.	—	0
19	59	56	3	53.5	4.06	83	B.	N.E.	1
20	59	55	4	52	3.78	77	B.	—	0
21	58	52	6	47	3.19	69	C.B T.	—	0
22	60	52	8	44.5	2.90	57	B.C.	—	0
23	58	53	8	48.5	3.38	72	B.	—	0
24	59	54	5	50	3.52	72	B.	—	0
25	60	56	4	53	3.92	78	B.	—	0
26	61	52	9	44	2.80	53	C.	N.E.	2
27	59	52	7	45.5	3	62	B.C.H.	N.	0
28	58	50	8	42	2.62	55	B.C.	N.	1
Mean.	61.1	54.8	6	49.3	3.50	67		0.5	

TABLE XLIII.

February, 1849.

1819.	HYGROMETER, 2 P.M.							
February.	t	t*	d	t**	e	Relative moisture.	Sky.	Wind.
	°	°	°	°	In.			
1	68	60	8	54.5	4.15	62	B.C.	N.E. 1
2	68	60	8	54.5	4.15	62	C.	N.E. 1
3	68	60	8	54.5	4.15	62	B.C.	— -
4	68	58	10	50.5	3.60	54	B.	E. 2
5	—	—	—	—	—	—	—	— -
6	70	64	6	60	5.09	72	B.C.H.	E. 2
7	72	54	18	35	2.04	27	B.	E. 1
8	72	52	20	27.5	1.52	20	B.	N.E. 1
9	—	—	—	—	—	—	—	— -
10	68	58	10	50.5	3.60	54	B.C.	N.E. 2
11	59	58	1	63	4.63	94	O.R.	N. 2
12	70	65	5	62	5.42	77	B.C.	N.E. 2
13	68	58	10	50.5	3.60	54	B.	E. 1
14	72	56	16	41	2.56	34	B H.	N.E. 2
15	72	63	9	57	4.58	60	B.H.	S.E. 1
16	70	56	14	43.5	2.80	39	O.	— 0
17	73	52	21	26	1.42	18	B.H.C.	E. b N. 2
18	69	62	7	57.5	4.62	67	B.	N.E. 1
19	66	60	6	56	4.36	71	B.	N.E. 1
20	67	59	8	53	3.98	62	B.C.	— -
21	68	58	10	50.5	3.60	54	B.C.	— -
22	68	56	12	45.5	3.02	46	B.C.	N.E. 1
23	67	57	10	49	3.43	53	B.C.	N.E. 2
24	66.5	59	7.5	53.5	4.03	64	B.	N.E. 1
25	67	60	7	55	4.26	66	B.C.	N.E. 2
26	62.5	52.5	10	43	2.74	50	B.C.	N. 2
27	63	52	11	41	2.55	45	B.C.	N. 2
28	62	52	10	42.5	2.68	50	B.C.	N.E. 3
Mean.	67.9	57.7	10.1	49.1	3.56	54		1.3

TABLE XLIV.

March, 1849.

1849.	HYGROMETER, 9 A.M.						Sky.	Wind.
March.	t	t^*	d	t^{**}	e	Relative moisture.		
	°	°	°	°	In.	°		
1	59	50	9	41	2.52	52	B.	— 0
2	61	53	8	46	3.02	58	B.C.	N.E.E. 2
3	60	54	6	49	3.41	67	B.C.	— 0
4	72	52	20	27	1.50	20	C.H.	N.E.E. 2
5	72	57	15	44	2.82	37	O.H.	N.E. 2
6	72	56	16	41	2.56	34	O.H.	— 0
7	70	58	12	48.5	3.34	47	C.H.	N.N.E. -
8	64	54	10	45.5	2.97	52	C.H.	S.b.W. 1
9	64	56	8	49	3.46	59	C.B.	N. 1
10	64	56	8	49	3.46	59	B.C.	N. 0
11	60	48	12	34	1.94	38	B.C.	N. 1
12	58	48	10	37	2.17	46	B.C.	N.E. 1
13	58	50	8	42	2.62	55	C.	— 0
14	64	56	8	49	3.46	59	C.	N. 0
15	63	54	9	46.5	3.06	54	C.O.T.	— 0
16	65	56	9	48.5	3.36	56	C.O.T.	S.W. 0
17	66	56	10	47.5	3.25	53	B.C.	S.W. 1
18	65	62	3	60	5.11	85	B.C.	W. 0
19	64	57	7	51.	3.74	65	C.O.	S.W. 0
20	66	58	8	52	3.80	61	B.	— 0
21	59	51	8	43	2.73	56	B.S.C.	N. 3
22	59	53	6	47.5	3.25	66	C.	N. 0
23	60	54	6	49	3.41	67	B.C.	S.W. 2
24	53	50	3	47.5	3.22	82	O.R.R.	N.E. -
25	—	—	—	—	—	—	—	— -
26	—	—	—	—	—	—	—	— -
27	—	—	—	—	—	—	—	— -
28	—	—	—	—	—	—	—	— -
29	—	—	—	—	—	—	—	— -
30	—	—	—	—	—	—	—	— -
31	—	—	—	—	—	—	—	— -
Mean.	63.3	54.1	9.1	45.6	3.09	55		0.7

TABLE XLV.

March, 1849

1849. March.	HYGROMETER, 3 P.M. t	t*	d	t**	e	Relative moisture.	Sky.	Wind.
	°	°	°	°	In.	°		
1	68	52	16	34.5	2	30	B.C.	N.E. 2
2	68	58	10	50	3.56	53	B.C.	N. b. E. 2
3	72	56	16	41.5	2.57	34	B.C.	N.E. 2
4	74	58	16	44.5	2.90	36	B.H.	E. 2
5	71	56	15	42	2.66	37	O.H.	N.E. 2
6	72	58	14	46.5	3.14	41	B.H.	N.E. 2
7	72	57	15	44	2.82	37	C.H.	N.E. 1
8	68	60	8	54.5	4.15	62	B.C.	S.W. 1
9	67	57	10	49	3 45	52	B.C.	N. 2
10	68	58	10	50.5	3.60	54	B.C.	N. 1
11	62	52	10	42.5	2.68	50	B.C.	N. 2
12	66	54	12	43	2.74	44	B.C.	N.E. 2
13	65	54	11	44	2.84	47	B.C.	N.E. 2
14	68	58	10	50	3.59	54	C.B.	N.E. 0
15	70	58	12	48.5	3 37	47	C.	— 0
16	69	57	12	47	3.18	46	C.B.	S.W. 1
17	68	58	10	50.5	3.60	54	C.B.	S.W. 2
18	69	62	7	57.5	4.62	67	C.B.	S.W. 1
19	70	60	10	53	3.91	55	B.C.	S.W. 1
20	70	58	12	48.5	3.37	47	B.C.	S.W. 1
21	66	54	12	43	2.74	44	B.C.S.	N. 3
22	64	58	6	53.5	4.02	70	C.B.	N. 0
23	58	50	8	42	2.62	55	C.S.T.	S.W. 2
24	62	56	6	51	3.70	68	C.B.	S.W. 1
25	—	—	—	—	—	—	—	—
26	—	—	—	—	—	—	—	—
27	—	—	—	—	—	—	—	—
28	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—
30	—	—	—	—	—	—	—	—
31	—	—	—	—	—	—	—	—
Mean.	67.8	56 6	11.2	47.1	2.82	49		1.5

TABLE XLVI.

April, 1849.

1849.	Hygrometer, 9 a.m.						Sky.	Wind.	
April.	*t*	*t**	*d*	*t***	*e*	Relative moisture.			
1	—	—	—	—	—	—	—	—	-
2	—	—	—	—	—	—	—	—	-
3	64°	56°	8°	49°	In. 3.45	59°	B.C.	S.W.	0
4	65	58	7	53	3.93	66	C.B.	—	0
5	65	59	6	54	4.19	70	C.	—	0
6	63	57	6	52	3.85	69	B.	—	0
7	63	58	8	52	3.83	62	Ċ.B.	S.W.	0
8	66	58	8	52	3.83	62	Ḃ.C.	—	0
9	68	60	8	54	4.18	62	B.C.	S.E.	1
10	67	60	7	55	4.20	68	C.B.	—	1
11	64	58	6	53	4.03	70	B.C.	S.W.	2
12	67	60	7	61	5.25	66	Ċ.B.	—	0
13	64	59	5	55.5	4.31	75	C.	—	0
14	67	63	4	60	5.11	80	B.C.	—	0
15	67	61	6	57	4.58	81	Ċ·B.	—	0
16	66	64	2	62.5	5.55	89	O.C.T.	S.W.	1
17	67	64	3	62	5.54	85	C.B.	—	0
18	67	62	5	59	4.87	76	C.B.	—	0
19	64	60	4	57	4.58	79	Ċ.B.R.	—	0
20	64	57	7	51.5	3.74	65	B.C.	—	0
21	60	52	8	44.5	2.88	57	Ḃ.C.T.	N.E.	1
22	64	56	8	49	3.46	59	C.B.	—	0
23	60	52	8	52.5	3 88	57	B.C.	—	0
24	59	54	5	50	3.53	72	Ḃ.C.S.	—	0
25	62	58	4	55	4.27	78	C.B.	—	-
26	64	58	6	53.5	4.04	70	B.	N.W.	1
27	62	52	10	54.5	2.68	50	C.B.	N W.	1
28	67	60	7	55	4.28	66	C.B	S.W.	0
29	70	63	7	58.5	4.81	68	Ḃ.C.	S.	1
30	70	60	10	53	3.91	55	B.C.	S.E.	0
Mean.	64.9	58.5	6.4	54.1	4.16	68		0.3	

TABLE XLVII.

April, 1849.

1849. April.	Hygrometer, 3 p.m. t	t*	d	t**	e	Relative moisture.	Sky.	Wind.	
1	—	—	—	—	—	—	—	—	-
2	—	—	—	—	—	—	—	—	-
3	69°	58°	9°	51°	In. 3.67	57°	C.B.	S.W.	0
4	67	59	8	53	3.95	61	C.	S.W.	1
5	66	57	9	50	3.51	57	C.	—	0
6	64	58	6	53	4.03	70	O C.T.	S.W.	1
7	70	62	8	57	4.50	63	C.B.	S.W.	0
8	74	60	14	49	3.45	43	B.C.	S.W.	1
9	73	62	11	55	4.21	54	B.C.H.	W.	2
10	72	62	10	55	4.27	56	B.C.	S.W.	1
11	69	60	9	53	4.01	58	C.T.	S.W.	2
12	64	59	5	55	4.31	75	C.T.	—	0
13	64	58	6	53	4.01	69	S.W.	—	1
14	73	66	7	62	5.40	69	B.C.	S.W.	1
15	67	59	8	53	3.98	62	C.	S.W.	1
16	66	64	2	62	5.55	89	C.F.R.	S.W.	1
17	66	63	3	61	5.25	85	O.R.	S W.	1
18	67	62	5	59	4.87	76	B.C.S.	—	0
19	66	59	7	54	4.08	66	O.T.	E.	1
20	66	60	6	56	4.35	70	C.B	S.E.	1
21	63	56	7	50	3.59	64	C.T.	N.E.	2
22	—	—	—	—	—	—	B.C.	S.E.	1
23	64	58	6	53.5	4.01	69	B.C.S.	N.E.	1
24	63	56	7	50.5	3.59	64	C.B.S.	S.W.	1
25	67	60	7	55	4.20	66	C.	S.W.	1
26	69	58	11	49.5	3.47	50	B.C.	S.W.	1
27	68	59	9	52.5	3.85	58	C.B.	S.W.	1
28	72	62	10	55.5	4.30	56	B.C.	S.W.	1
29	72	62	10	55	4.30	56	B.C.	S.E.	1
30	66	60	6	56	4.39	71	C.T.	S.W.	1
Mean.	67.6	60	7.6	54.5	4.19	61		0.9	

TABLE XLVIII.

May, 1849.

1849.	Hygrometer, 9 A.M.						Sky.	Wind.	
May.	t	t*	d	t**	e	Relative moisture.			
1	62°	52°	10°	42.5°	In. 2.68	50°	C.B.	N.W.	1
2	62	56	6	51	3.70	68	B.C.	W.	2
3	70	60	10	53	3.90	55	B.C	W.	1
4	73	52	11	41	2.52	44	B.C.	S.E.	0
5	66	60	6	57	4.50	75	C.	S.W.	0
6	67	59	8	56	3.98	62	B.T.	—	0
7	68	60	8	54	4.14	62	B.	—	0
8	68	60	8	54	4.14	62	B.	S.W.	1
9	68	60	8	54	4.14	62	B.	—	0
10	69	64	5	61	5.26	76	B.	S.W.	0
11	68	62	6	58	4.71	71	B.	S.E.	0
12	70	64	6	60	5.09	72	Ḃ.	S.W.	0
13	70	69	6	60	5.09	72	C.B.	S.E.	1
14	68	62	6	60	5.09	72	B.	S.W.	1
15	65	58	7	53	3.93	66	B.	S. b.W.	1
16	66	60	6	56	4.35	70	B.	S.E.	1
17	69	62	7	57.5	4.60	67	Ḃ.	E.S.E.	1
18	67	59	8	53	3.92	62	Ḃ.C.	S.W.	0
19	66	62	4	59.5	4.98	79	Ḃ.	—	1
20	68	62	6	58.5	4.71	71	B.	W.S.W.	1
21	68	63	5	60	5.04	76	B.	S.W.	1
22	70	62	8	57	4.50	63	B.	S.W.	1
23	—	—	—	—	—	—	—	—	-
24	67	62	5	58.5	4.83	75	B.C.	S.S.W.	1
25	72	62	10	55	4.27	56	B.C.	—	0
26	69	63.5	5.5	59.5	5.00	76	B.C.	S.S.W.	1
27	68	64	4	62	5.37	80	B.C.	S.S.W.	1
28	68	64	4	62	5.37	80	C.B.	—	0
29	68	60	8	54	4.15	62	B.C.	S.S.W.	1
30	68	62	8	57	4.51	63	Ḃ.C.	S.S.W.	1
31	68	64	4	59	4.85	64	B.C.	S.W.	1
Mean.	67.87	60.80	6.8	56.1	4.44	67		0.7	

TABLE XLIX.

May, 1849.

1849.	Hygrometer, 4 p.m.						Sky.	Wind.
May.	t	t^*	d	t^{**}	e	Relative moisture.		
	°	°	°	°	In.	°		
1	56	50	6	44	2.86	65	C.B S.S.	W.N.W 2
2	68	58	10	50.5	3.60	54	B.C.	S.W. 1
3	66	52	14	37.5	2.22	35	B.C.	S.W. 2
4	72	58	14	46.5	3.12	41	B C.	W. 2
5	69	61	8	55.5	4.31	62	B C	S.E. 1
6	70	60	10	53	3 91	55	C.B.	S.E. 1
7	70	61	9	55	4.21	59	B.C.	S.E. 1
8	70	62	8	57	4.51	63	B.C.	S.W. 1
9	69	61	8	57	4.51	63	C.B.	S.W. 2
10	71	64	7	59.5	4.98	68	C.	S W. 0
11	80	66	14	55	4.21	46	B.	S.E. 1
12	75	67	8	62.5	5.59	65	B	S. 1
13	76	66	10	60	5.03	59	B.C.	S.E. 1
14	70	64	6	60.5	5.14	72	C.	S W. 1
15	68	60	8	54.5	4.18	62	B.C.	E. 1
16	71	64	7	60	5.00	68	B.C.	S.E. 0
17	70	64	6	60	5.09	72	B.C.	S.E. 0
18	68	62	6	58	4.71	71	B.	S.S W. 1
19	71	63	8	58	4.71	64	B.	W S W. 1
20	73	64	9	58	4.75	61	B.	S.W. 1
21	70	64	6	60	5.09	72	C.	S.W. 1
22	77	62	15	51	3.70	42	B.C.	E. 2
23	—	—	—	—	—	—	—	—
24	70	64	6	60	5.09	72	C.H.O.	S.W. 1
25	77	65	1	57.5	4.65	52	B.C.	S.W. 1
26	72	65	7	61	5.21	69	B.C.	S.W. 1
27	72	61	11	53.5	3.98	52	C.B.	S.W. 0
28	68	64	4	62	5.37	80	C O	S.S.W. 1
29	67	59	8	53	3.95	61	B.C.	S.S.W. 1
30	72	62	10	55.5	4.27	56	B.	S.W. 1
31	72	64	8	59	4.85	64	B.C.H.	S.W. 1
Mean.	70	62	8.8	55.8	4.42	61		1.0

EXTERNAL TEMPERATURE.

TABLE L.

SHOWING THE MEAN, MEAN MAXIMUM, AND MEAN MINIMUM TEMPERATURE, FOR THE MONTHS AS BELOW; THE MEAN AND EXTREME MONTHLY RANGE OF TEMPERATURE; MEAN HEIGHT OF BAROMETER; MEAN DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS; MEAN DEWPOINT; MEAN ELASTIC FORCE OF THE VAPOUR; AND MEAN RELATIVE MOISTURE.—AT MR. HOLLWAY'S, CAMINHO MEIO, 280 FEET ABOVE THE LEVEL OF THE SEA.

1848 and 1849.	Mean.	Mean maximum.	Mean minimum.	Mean monthly range.	Maximum.	Minimum.	Extreme range.	Aneroid Barometer, 9 a.m.	Aneroid Barometer, 4 p.m.	Difference between wet and dry bulb Thermometers, 9 a.m.	Difference between wet and dry bulb Thermometers, at 2, 3, and 4 p.m.*	Dewpoint, 9 a.m.	Dewpoint, 2, 3, and 4 p.m.*	Elastic force of the vapour, 9 a.m.	Elastic force of the vapour, 2, 3, and 4 p.m.*	Relative moisture, 9 a.m.	Relative moisture, 2, 3, and 4 p.m.*
	°	°	°	°	°	°	°	In.	In.	°	°	°	°			°	°
December.	63.7	67.0	60.4	6.6	70.5	63.0	7.5	29.85	—	4.7	—	—	—	—	—	75	70
January...	61.7	67.0	56.6	10.4	70.5	53.0	17.5	29.99	29.96	6.0	6.6	51.2	54.4	3.74	4.16	72	68
February .	62.5	68.2	56.8	11.4	73.0	53.0	20.0	30.02	29.98	6.0	10.1	49.3	49.1	3.50	3.56	67	54
March ...	63.5	69.3	57.2	11.8	75.0	52.5	22.5	29.92	29.86	9.1	11.2	45.6	47.1	3.09	2.82	55	49
April	62.3	67.6	57.4	10.2	74.0	54.5	19.5	29.80	29.78	6.4	7.6	54.1	54.5	4.16	4.19	68	64
May	65.3	70.7	59.9	10.9	78.0	54.0	24.0	29.75	29.78	6.8	8.8	56.1	55.8	4.44	4.42	67	61

* See previous Tables for each month, for the respective hour of observation in the afternoon.

EXTRACTS FROM THE OBSERVATIONS OF G. A. YOUNG, ESQ., TAKEN IN 1848 AND 1849.

Observations made at 9 a.m.—an Aneroid Barometer used—situation, a Quinta in the Loo Fields, about 100 feet above the level of the sea.

		Barometer.	Thermometer.
1848—October	Mean	29.98	70°
November	do	29.92	67
December	do	29.98	67
1849—January	do.	29.96	64
February	do.	30.02	65
March	do	29.83	63
April	do	29.80	64
May	do.	29 83	67
June (15th)	do.	29.80	69

Mr. Young makes the lowest monthly average of temperature, from October to June, 63°, which is for the month of March, and the highest, 70°, being that of October. Snow was seen on the mountains from the 23d of March until the 9th of April, and on the 22d to the 24th; also, from the 1st to the 5th of May; a very unusual occurrence so late in the year. The winter, however, of 1848-49, was another *remarkable* one for Madeira, and certainly one of the coldest for a great number of years, fully substantiating all that has been

advanced by Dr. Mason, on the variability of the climate *even* in that Island.

Only a few winters before, when a friend was on a visit to me, the nights were so mild, that in the absence of rain, which very rarely fell, we used frequently to go out and enjoy the balmy air on the terrace of the Quinta; but during the season in question, such opportunities rarely occurred,—and even in-doors, we were often glad to avail ourselves of a fire. In fact, I do not remember an occasion when complaints of the weather were a fourth part so general among the visitors; and what rendered the peculiarity the more striking, was the account, brought by every packet, of the exceeding mildness of the temperature in England. Here we discover an additional corroboration of the accuracy of Dr. Mason's views, in recommending the necessity of constant and numerous observations;—that patients and their friends may be thoroughly prepared for any variation that may occur in the climate of this Island.

PART IV.

ON THE

AGRICULTURE AND TENURE

OF

LAND IN MADEIRA.

BY G. PEACOCK, D.D., F.R.S.
&c., &c., &c.

DEAN OF ELY, AND LOWNDES' PROFESSOR OF ASTRONOMY IN THE UNIVERSITY OF CAMBRIDGE.

CHAPTER XVI.

ON THE AGRICULTURE AND TENURE OF LAND IN MADEIRA.

The surface of the Island of Madeira is singularly broken and mountainous;—with the exception of a small portion, near the sea, on the west coast, and the lofty Table Land of the Paul da Serra, there is absolutely no level ground. From the central region of the Curral, where the Pico Ruivo and other mountains attain an elevation of more than 6000 feet, a series of steep and generally hog-backed ridges separated by deep ravines, the channels of the mountain torrents, radiate in all directions to the sea, declining, for the most part, in height as they approach it. The coast line, however, which they form, is remarkably varied and bold. Cape Girão, which terminates one of these ridges, about 5 miles to the west of Funchal, attains an elevation of nearly 2000 feet, and is one of the noblest promontories in the world. Cape Garajão, or the Brazen Head—so named from the predominant redness of its colouring—forms a less lofty, but

not less picturesque, object, at about the same distance on the east. In pursuing our course round the Island, from the east to the north, we pass the lofty headlands which bound the beautiful vale of Machico—the long, narrow, and broken ridge of basaltic hills, which forms the point San Lorenzo—the Penha d'Aguia, or Eagle Rock, a lofty mountain mass, somewhat in the shape of a truncated square pyramid, near Porto do Cruz, and the grand succession of sea cliffs of the most varied forms which intervene between Santa Anna, San Vicente, and Porto Moniz. There is no coast scenery in the world which is finer than the north of this Island.

The Island is entirely volcanic. With the exception of the remarkable fossil beds at Caniçal, near point San Lorenzo, and a bed of marine limestone, which crosses a mountain torrent not far from San Vicente, there is no rock to be found in it which belongs to any other formation;—and, even of these, the first is observed to pass beneath the volcanic beds adjoining it, and the second is intersected by basaltic dykes; thus evidently showing that they are anterior, in the time of their deposition, to the cessation of volcanic action.

These volcanic rocks and beds present, as might be expected, the usual succession of varieties which are characteristic of such formations. We find *compact* basalt* sometimes occurring in forms which are

* Called by the natives *Pedra viva*, or *Alvenaria*. It is the favourite building stone of the Island; they work it with great skill and facility, notwithstanding its great hardness, and the apparent rudeness of their tools

either rudely columnar or divided by vertical parallel joints or *fendas;* and sometimes in beds which are extremely irregular in their inclination and thickness, as if they had overrun the subjacent strata in a semi-fluid state. It is found, sometimes, slaty in its structure, admitting of a very distinct cleavage; sometimes, it is *vesicular** and less compact, being full of minute air cells; whilst, at other times, it is so completely *scoriaceous* in its aspect and composition, as to be hardly distinguishable from the slag of an iron furnace. All these varieties are occasionally found in the same bed, passing from the first of them to the last, as we recede from the interior to the surface.

Extensive beds of *Tufas* are intermixed with others of basalt and *scoriæ;* sometimes, loose and friable, at other times, more or less firmly consolidated, and decomposing slowly under the action of the atmosphere. The beds of loose, or very slightly agglutinated scoriæ, ashes, and pumice, are frequently of great thickness. Sometimes, we meet with beds of white *lapilli,*† lighter than water, intermixed with earthy particles, not deposited in the order of gravity, and therefore not formed at the bottom of the sea. They are generally very loose and incoherent. We meet with other beds, frequently of vast thickness, which seem to have been formed by torrents of mud, intermixed with ashes and fragments of volcanic substances. When these have been overrun by

* Called also *cantaria rija,* or *hard ashlar.*

† Called *Fujaco branco.*

melted lava, they assume the colour, and, sometimes, nearly the consistency, of brick; exhibiting the most striking and picturesque contrasts with the dark masses which overlie them.*

Of an Island, thus physically constituted, a very large portion may naturally be expected to be incapable of cultivation. "It is so rugged, mountainous, and full of rocks," (says an ancient historian,) "that hardly two parts in ten are cultivated; for, commonly, there is no level ground, except in small mouthfuls."† When first discovered and settled by Gonzalves Zargo, in 1419 and 1421, those parts of it which were not bare rock are said to have been covered with vast forests of timber; and the founders of the city of Funchal—to which the first settlers were invited by its beautiful bay, by the noble amphitheatre of mountains which form its background, and by the unusual extent of land of a

* When mixed with volcanic ashes, and hardened by volcanic action, they form a very common building stone, called *cantaria molle*, or *soft ashlar*.—[See an excellent memoir in the *Journal of the Geological Society, on the Geology of Madeira*, by Mr. Smith, of Jordan Hill.]

† "Tam fragoso, montuoso e cheio de pedras, que a penas se cultivâo della dois des dez partes; porque communamente nâo ha nella chá, senâo a bocados." —*Historia Insulana das Ilhos a Portugal Sugeytas no Oceano occidental.* Composta par Antonio Cordeyro da Compagnia de Jesu: Lisboa, 1717. A copy of this very rare and interesting work, belonging to Dr. Oliveira, a brother of Count Tojal, and one of the most eminent merchants in Funchal, was placed in my hands by my friend, Mr. James Kent, a gentleman to whom I am indebted for much of the information which I have been enabled to procure, relating to the history and statistics of the Island. The history of Cordeyro is, to a great extent, abridged from a very voluminous MS. work, never printed, of Dr. Fructuoso, a monk of Tereeyra, in the Azores; Captain Azevedo, a very distinguished engineer, who has made an accurate survey and map of the Island and also collected very extensive materials for its history, statistics, and geology, showed me a transcript of all those parts of this MS. which relate to Madeira.

moderate elevation and not extreme irregularity of surface, which intervenes between them and the sea —found no means of establishing their footing, and of clearing the ground before them, so ready as that of setting fire to the wood. The conflagration is said to have extended over the whole southern portion of the Island; and to have been, at first, so furious, as to compel the adventurers to take refuge in their ships, in order to escape the scorching heat which it occasioned. It is recorded—and there is no reason to dispute the fact*—that the fire continued burning during seven years; for, when the parts of the trees above the surface were consumed, it continued to pursue their roots beneath the light and porous soil in which they grew; where, —as is perfectly reconcilable with experience—a slow combustion might continue to be maintained for a very long period.†

It is probably owing to this cause, as well as to the great usefulness, excellence, and beauty of many of the native woods, that so much of the indigenous timber of the Island has disappeared.

* Cordeyro, after Fructuoso, records this conflagration. There was no other method, equally prompt and certain, of clearing the country, and preparing it for cultivation. Burnt ashes, also, form the richest of all manures. It is the custom, at this time, to burn the furze and broom on the sides of the mountains, as a manuring, preparatory to a crop of rye, or other grain. I recollect observing, on the 4th of February, 1849, a cloud of a very extraordinary character, which created no small degree of speculation at Funchal. It was soon discovered, however, that it arose from an extensive conflagration, thus produced, on the mountains I passed through the burning district—not without some inconvenience—on the following day, on the road to Sta. Antonio da Serra.

† The slow subterranean combustion of coal or peat—which has been frequently observed—is a fact of the same kind.

The native cedar*, once so abundant, is now no longer to be found. Of the dragon trees, not more than six or seven are to be found on the Island. The til, the vinhatico, and the folhado—the two first of which form very valuable timber—are rapidly disappearing.† The tree heaths—erica arborea—are still found of considerable size, and in great numbers, in the mountains; but the non-desiduous trees—which alone are indigenous in a semi-tropical island—have been very generally replaced by the desiduous trees of a more northern climate. Thus, the Spanish chesnut, has been planted everywhere; supplying an important article of food for the people, and furnishing the north of the Island with support for the vines, which are trained upon them. The oak, the walnut, the plane tree, have been largely introduced; both as ornamental and useful timber. The pine grows rapidly in the mountains, and has been very extensively planted, particularly by Senor D'Ornellas —a most intelligent and enterprising Portuguese gentleman—on the high lands belonging to him on the north-east of Funchal. The larch has been tried, but does not flourish. All the trees of Aus-

* The beautiful roof of the Sé—Cathedral—is of the Island cedar; it is found very generally in the roofs of the more ancient houses.

† They are still found in great abundance and of a magnificent size, in the mountains and ravines; more particularly in those parts of the north of the Island, which are too precipitous to be accessible to the wood-cutters and charcoal burners. The til is the Laurus Fœtens; its wood is black and hard; and gives out, when rubbed, a very offensive smell. The Vinhatico—another laurel—is the mahogany of the Island; and is extensively used for making ornamental furniture.

tralia, Japan, and China, are found to grow luxuriantly; particularly, at an elevation of about two thousand feet above the level of the sea; as may be seen in the beautiful gardens of Mr. Gordon and Mr. Consul Stoddart, at the Mount Church; and of Mr. Veitch, at the Jardim da Serra*, close to the Curral.

It is a fact now well understood, that, though there is always a very extensive range of climate, within which the same trees will flourish; yet no length of time will tend to acclimatize them; or, in other words, so to modify their periods of foliation, flowering, and fruit-bearing, as to adapt them to the new conditions of the seasons and climate to which they are transferred. Our apricot and peach trees continue to flower, prematurely, during our harsh and inclement springs; and their fruit is ordinarily only saved from destruction by the aid of artificial protection.

The custard apple—annona squamosa—and its congeners, the natives of semi-tropical regions to the south of the Equator, bring their fruit to maturity in Madeira in the winter, and change their foliage in the summer; irrespective of the reversal of the seasons in passing the line. Trees, also, which are desiduous in a northern climate, continue desiduous, when removed to a locality where all the indigenous trees are evergreen. They shed their leaves in the autumn, as with us, and resume

* Mr. Veitch cultivates the tea plant in the same garden, and prepares and uses its produce exclusively in his household.

them, after their accustomed periods of repose, in the spring; at times, not much accelerated by the increased influence of warmth and sunshine. Thus, the foliation of the Portuguese oak, which is nearly the first in order, takes place in the beginning of March. The plane tree and the fig follow, at the beginning of April, whilst the Spanish chesnut is found almost leafless at the beginning of May. Few things, in Madeira, surprise a stranger more than the apparent sluggishness of vegetation in the spring, under the operation of an amount of light and heat, which, in our climate, would be sufficient to clothe, at the end of winter, whole forests with almost instantaneous verdure.

The progressive destruction of the forests, since the first discovery of the Island, has very materially modified the climate, by making it less humid. The smooth surfaces of the leaves of trees of the laurel tribe, cool rapidly by radiation, when the sky is clear; and the dew being, consequently, deposited profusely upon them, they collect and distil, as it were, water, in great abundance from the atmosphere. When the Island was first discovered, and for many years afterwards, while the northern mountains were covered with evergreen trees, the river Socorridos—the most considerable in Madeira—which runs through the Curral, was found to be sufficiently deep to float timber to the sea; which it enters near Cama dos Lobos. It is now reduced—when not suddenly flooded—to a small stream, almost lost in the loose rocks which occupy its

channel. It would appear that the attention of the settlers was called, at a very early period, to the injurious effects produced by the rapid diminution of the forests in a country; where, from the dry and porous character of the soil, and the warmth of the climate, moisture becomes the great principle of fertility. A law was made, and is still in existence—though, unhappily, like other laws in this Island, very rarely or very imperfectly enforced—which made it penal to cut down a vinhatico, or til, if found near a fountain, or on the banks of a river. The same effects have been found to follow, in a greater or less degree, in all countries, whether tropical or not, from the diminution of timber, whether produced by the extension of cultivation, or by other causes*.

* Cordeyro has recorded a very remarkable example of the capacity of the til tree to distil water from its leaves. The Island of Ferro, the most western of the Canaries, is very rocky, and possesses neither fountain nor stream. It presents a lofty and precipitous cliff to the sea at all points but one, from which a deep valley passes through the centre of the Island, merely interrupted, near its centre, by a lofty ridge which crosses it. On this summit stands a til tree of great size, its trunk being twelve paces in circumference. The sea breeze passes up the valley, and a white mist is observed nearly every day, and especially in the morning, to form around this solitary tree—whose leaves distil sweet and pure water in such abundance that, being collected at a tank at its base, it supplies drink to all the inhabitants and cattle on the Island. The tree was called, in the ancient language of the country, *Garse*, or holy tree; and many marvellous properties were attributed to it. It was said to remain always in the same state, neither increasing nor diminishing; its leaves never changing nor decaying—"a symbol," says the author, "of the Providence of God, Who never ceases to watch over the welfare of His creatures." Glas, in his *History of the Discovery and Conquest of the Canary Islands*, published in 1764, has described this tree, confirming, substantially, the account of it which is given by Cordeyro. I am not aware whether it is now in existence.

Of the public works of Madeira, the *levadas* are much the most considerable, and the best managed. They are water-courses of masonry, which are diverted from the mountain streams, frequently at very great elevations; and are conducted, sometimes along the faces of precipices, or on the sides of the mountains, to various points of the cultivated lands, from whence their distribution begins. There is, for every *levada*, a monthly cycle of *giri*, or turns, of one hour each, which are made the subject of purchase and sale, like other rights appurtenant to property. Subordinate channels are made to convey it to the several occupations which have a right to claim it, in the order of succession best suited to distribute it, without waste or loss of time, in passing from one of them to another. The Portuguese law appears, generally, to have made very especial provision for its equitable apportionment, though no subject is found to occasion so much dispute and litigation. If the main channel is divided at any point of its course, and directed to different districts, one is said to be more favoured than another. The stream which B claims for an hour is detained by A, through the improper connivance of the officer, beyond its just time; or is allowed, by negligence, to be wasted in its progress. In a climate like that of Madeira—where water is wealth, particularly in the summer season, when the crop flourishes or dies, according as it is or is not supplied with moisture—these questions become of vital importance to the culti-

vators; and can hardly fail to stimulate the passion for law which is so natural to all mankind. As might be expected, the supply of water, furnished by the *levadas*, is apt to fail at those seasons of the year when it is most wanted: the mountain streams which supply them are partially dried up; the channels are not water-tight; much of it is evaporated by exposure to a clear sky and thirsty atmosphere; and the remainder, when it reaches its destination, is not adequate to supply sufficient moisture to the parched and heated soil. The continued destruction, likewise, of the forests in the mountains, which we have noticed before, is tending, every year, to increase this evil.

The roads of Madeira are quite insufficient for the wants of the population, and for the easy and rapid interchange of commodities and produce. Some of those, more recently made, particularly near Funchal, are very carefully constructed and paved. They use now, generally, for this purpose, small flat chips of broken basalt, which are wedged in, compactly, together; and form a surface sufficiently smooth for a sledge, and sufficiently rough to afford a firm hold for the shoes of horses, which are upturned before and behind, like those of horses in England during the prevalence of a severe frost; but those of more ancient date are either formed of large flat or rolled pieces of basalt, which are both rough and slippery; or are only rudely levelled by removing the turf and larger fragments of rock, and are, consequently, when

exposed to the action of the mountain torrents, during the heavy tropical rains, furrowed up, not unfrequently, to a depth of several feet, so as to make them impassable to all but the sure-footed ponies of the Island. There is, in fact, no continued, well-formed road of any extent to be found; none, connecting the more distant and important points of the Island with each other, which are practicable even for the simple, yet powerful, sledges upon which weights, too heavy for man to bear, can be transported. There is no greater obstacle than this want of good and practicable roads, to the development of the resources of the country.

In the construction, also, of roads, little attempt is made to mitigate their almost precipitous steepness, by judicious cuttings, embankments, or turnings. There is a principal road in the northern part of the Island, near Santa Anna, which has the extraordinary inclination of 27°: whilst one of the most carefully-paved roads recently made, leading to the Quinta and the pine woods of Senor D'Ornellas, on the mountains on the north-east of Funchal, has an inclination of 23°; and has, consequently, received the not inappropriate name of the *rocket* road or *caminho do foguète.* A road with an inclination of 1 in 4 is considered practicable and convenient; whilst the Simplon, which was adjusted, by the French engineers, nearly to the limit of inclination which is easily practicable for carriages, has an inclination of only 1 in 12. The

new road, leading, by the sea-coast, to the ruined bridge on the River Socorridos, near Cama dos Lobos, which was in the course of construction last year (1849), is an exception to these observations. By the aid of a noble bridge over the Rio Seco, on the west of the Ilheo fields, commonly called Nuno's Bridge*, and a judicious selection of the route, it is made sufficiently level to be practicable for light carriages; the introduction of which would add greatly to the resources of the more delicate and timid of the invalids.

Every male of mature age in Madeira is required, by law, to contribute either one dollar or five days' labour to the repair of the roads; there being no other public provision for that purpose. The contribution is very frequently not paid, or not applied to its object; as the labour of the poor, like all compulsory labour, except in a state of slavery, is very ineffective and irregular. The repairs, also, under the direction of the different municipal bodies, are conducted without system and without concert; and the resources, at their command, are still more frequently expended, less for the general benefit of the community, than to favour the property of some influential proprietor. We thus frequently find some by-road most carefully and elaborately paved, whilst the main routes are unfinished and

* Nuno de Carvalho, a well-known and extremely popular officer of the government, of great integrity and merit, whose exertions have greatly contributed to the success of this important work.

not practicable for sledges with heavy weights. A very large portion of the inhabitants—probably one-third—are thus, from necessity, employed in the carriage of fuel from the mountains, and of articles of agricultural and garden produce, from one part of the Island to another. Wine in pipes, or large casks, can only be sent from one port, or rather beach, to another by boats; and, if brought from inland districts, it is carried by men in skins, or small barrels.

The richer soils are usually found in the lower levels, near the sea; or at the bottom of the ravines. For the violent rains, which are characteristic of a semi-tropical climate, wash the lighter vegetable soils down the steeper acclivities with a rapidity which must be seen to be fully understood. The soil, on the more precipitous parts of the Island, is, in part, only maintained in a state of cultivation by walls and terraces, succeeding each other, frequently, within the distance of a few feet; and which not only serve to divide the different occupations from each other, but likewise to protect the soil from the violent rush of the torrents. Generally speaking, however, the character of the soil in different localities is chiefly determined by the character of the out-crop of the successive volcanic beds. A mixture of red and yellow tufa, called *saibro* and *pedra molle*, the latter of which is very light, loose, and friable, forms the best soil for the vine. In very dry situations, a slight addition of a clayey soil, called *massapez*, is found to be de-

sirable. The *cascalha*, a decomposing basaltic conglomerate, is also a good soil for the vine. The least favourable soils are those composed of the *massapez*, *barros*, *maracote*; the two latter of which are clays of a reddish colour. They prevail extensively to the east of Funchal.

The finest wines are produced on the gentle hills, to the west of Funchal, as far as Cama dos Lobos and the Estreito. The finest Malmsey, on an estate, formerly belonging to the *Jesuits*, still called *Fazenda dos Padres;* which is an extensive landslip, at the west part of the base of Cape Girão. Some wines of a delicate flavour are produced at Santa Cruz; and some, also, in the lowlands near Porto do Cruz, on the north; but the wines, generally, of the north of the Island, are very imperfectly matured; and are either distilled into brandy, or are exported to the extent of nearly two thousand pipes yearly, to Hamburg; where they are said to be manufactured into Hock. The same remark applies to all the wines, even in the most favoured aspects and soils, if produced at an elevation exceeding fifteen hundred feet.

More than half the surface of the Island is found at an elevation of more than two thousand five hundred feet above the level of the sea, which may be considered as the superior limit at which cultivation generally ceases; for, though a crop of rye may sometimes be grown at higher levels, the general barrenness of the soil, the violence of the storms, and the droughts of summer, where there

is no artificial irrigation, make it very scanty and uncertain. A large portion of these mountain tracts are covered by the *Vaccinium*—Barberry—tree-heaths, broom, furze, and other shrubs, both indigenous and foreign; which, by being cut for fuel, and carried to Funchal, afford occupation to great numbers of the people. The other parts, when not bare and sterile rock, afford a very scanty herbage for cattle, goats, and the miserable long-tailed sheep of the Island. In the region between two thousand and two thousand five hundred feet, the pine, and nearly all the timber trees of Europe, China, and New Holland, are found to flourish,—when planted,—in great luxuriance. The Camellia Japonica, in particular, attains a height of forty or fifty feet; and may be seen in great beauty at the Palheiro, the garden and park of the late Count Carvalhal, about three miles to the east of Funchal. All the fruits of Europe, also, the apple, the pear, the peach, attain the greatest perfection in this region. The cultivation of the banana and sugar cane ceases at an elevation of one thousand feet. At lower levels, and particularly in sheltered situations, near the sea, we find the coffee tree, and nearly all the productions of the tropical climates. The date palm, when not stripped of its leaves for the exhibitions of Palm Sunday and Easter, produces fruit, though it never arrives at perfection. The broad light green leaves of the banana, the intense bright green of the orange tree, always in fruit or in flower, the tall

stems and spreading tops of the palms; are amongst the most picturesque objects in the varied landscapes of this beautiful region.

The sugar cane was once very extensively cultivated. It was introduced from Sicily, by the illustrious Prince Henry of Portugal, under whose auspices the Island was discovered and settled. It was first planted at Machico; as well as the Malmsey grape, which he had brought from Candia. Cordeyro, at the beginning of the last century, in describing the Island topographically, speaks of sugar mills as established in almost every part of the south coast. There were several at Funchal, and two at Cama dos Lobos. "Half a league beyond it," says he, "we find the great Quinta of Luis d' Noronha, with a sugar mill and chapel—half a league beyond the Ribiero d' Taboa, is the Lombado of John Esmeraldo, the Genevese. He used to make twenty thousand arrobas of sugar. And his house is described as the largest in the Island; and, though no longer occupied, still continues to deserve that character. "The present occupier," says he, "Christopher Esmeraldo, has eighty slaves." It was, doubtless, owing to the facility of introducing slaves from the African coast, that the cultivation of sugar was so much extended as to become a large article of export. It is questionable whether it was the general prevalence of a disease which affected the sugar canes, or the superior cheapness of its production in the Brazils, which first caused its cultivation to de-

cline. At present there are only two sugar mills in the Island—one, at Praya Bay; the other, of superior construction, near San Martinho. The process of the manufacture terminates in the making of molasses and rum.

Wheat is extensively cultivated, and probably occupies not less than one half of the arable land. The produce, however, is not equal to more than a fourth part of the consumption of the Island. The species is the bearded kind, and is excellent in quality; though the average produce per acre, for reasons which will hereafter be stated, is extremely small. A small quantity of barley is grown in the same districts with the wheat, whilst the cultivation of rye is chiefly confined to the mountains. The cultivation of Indian corn has lately been introduced near San Vicente, with great success; and might be very advantageously extended to other parts of the Island. It forms a principal article of the food of the people, and is imported in large quantities from America and the Azores. The potato is, naturally, well suited to the light soil of Madeira; and is amongst the few articles of human food which can be cultivated, successfully, in the mountains. If water and manure could be procured, three crops might be grown on the same ground in the same year. Great numbers of the poorer classes, especially in the remoter districts, have been accustomed to trust to this vegetable for their chief support; and its extensive failure, of late years, from the prevalent disease,

has produced effects very similar to those observed in Ireland and elsewhere.

The *inhame*—yam—not the true yam of the West Indies, but a species of *arum*—is grown near the rivers and the water-courses, where the ground can be kept constantly moist. It is very productive, and, though a coarse food, "which somewhat stings the throat,"* says Cordeyro, is much sought after from its cheapness. The sweet potato—batata, or convoloulus edulis—is largely grown; and is one of the commonest and most agreeable vegetables produced in the Island. Cabbages are cultivated by every occupier of ground, like the kale in Scotland; and for the same uses. Pompions and water melons are produced abundantly. The common garden vegetables of Europe—asparagus excepted—are to be found at nearly all seasons of the year; but they are rarely of a superior quality.

Of the Island fruits, the oranges are much the most abundant. They are not, however, grown extensively for exportation; and, being cultivated with less care, are inferior to those produced in the Western Islands. The guava and the banana are abundant and cheap; the custard-apple is much less common, and rarely appears in the public markets; and the pineapple is grown in the open ground, but is nowhere of first-rate excellence.

Figs, peaches, and apricots, are produced in profusion, in the summer season; but, as the trees are rarely, if ever, grafted, the produce is of very

* Picao algam tanto na garganta.

inferior quality. Apples and pears are grown, chiefly, in the higher grounds; and are of excellent quality, when their cultivation is attended to. Grapes are grown for wine, and not for the table; and those which are the best suited for one purpose are, generally, the worst for the other. There are, in fact, few species of fruit, either of the tropics or of temperate climates, which might not be produced in the greatest abundance, and of the finest quality; if the requisite degree of care were taken in their cultivation, and in the selection of the proper localities, for growing them.

The peculiar tenure of land in Madeira—which prevails more or less in Portugal, Spain and Italy; and is a relic of the dominion, and agricultural system, of the Romans—is so intimately connected with the condition, both of the cultivation and the cultivators, that it cannot be satisfactorily treated, apart from the latter. During my stay in the Island, in the course of the last winter—1849—I paid particular attention to the conditions of this tenure, and to the consequences which it appeared to produce. This is a subject about which it is difficult to procure very accurate or precise information. There are no Portuguese books—or, at all events, none which I could procure—which describe it. There are no published statistical details; and none, in manuscript, which are easily procurable. The codes, also, of the Portuguese law, though excellent in principle, and such as, if executed, would be very effective in their opera-

tion; are so very imperfectly administered, as to place, in many important cases, the theory and the practice in striking contrast with each other. Under such circumstances, I felt myself compelled to depend, partly, upon personal inquiries and observations; and, partly, upon a series of replies, made by a most intelligent Portuguese gentleman; and procured by the kindness of my friend, Mr. James Kent, to queries, which I had prepared very carefully, upon the relations of landlord and tenant; and the effects which they produced upon the cultivation and subdivision of the land; and upon the general condition of the people.

The charters given to Gonzalves Zargo and Tristão Vaz, the first Donatories and Captains-General—the one of the south-east, and the other of the north-east, division of the Island*—were of the most extensive description; though they contained only the usual powers which were conferred on the leaders of new settlements; and which were, probably, considered the best calculated to maintain the royal authority, and to secure the speedy and effectual occupation of the territory. These eminent commanders were made absolute lords of the soil: they had full civil and criminal jurisdiction, except in cases of death and loss of limb, when an appeal was reserved for the crown; they possessed

* Funchal was the capital of the first division, which extended from the Brazen Head to Porto Moniz: Machico of the second, which included the remainder of the coast. The remains of the great Quinta of the Capitão Mor, in the beautiful vale of Machico, are still in existence.

the exclusive right of erecting mills, whether for grinding corn, or sawing timber; they, alone, could erect ovens for public baking, though all persons were allowed to erect and use them in their own houses for their own use; they had the monopoly of salt; they were further entitled to claim a tenth part of all the royal revenues; they, alone, possessed the right of granting lands, by charter; generally upon the principle called that of *Sesmaria*, whereby the grantee was required to provide, in the course of five years, a *casa*, *cafua*, and *curral*, or, a house, a shed, and a fold; and to put the land in a condition for cultivation. If these conditions were not fulfilled, the lord could resume possession; or grant the lands to another person. The grants, thus made, were continued to his heirs, according to the custom of Portugal; and, in default of heirs, or a legal devise, they reverted to the crown; or to the representatives of the original donatory, if any existed, according to the conditions of the original charter. The concession of these extraordinary powers to the leaders of these colonies, was, in some respects, rendered necessary by the dangerous character of a great majority of the first settlers. Though they were accompanied by many members of the first families of Portugal*, always ready, in those chivalrous times, in a singularly

* Amongst the names of the earlier settlers we find Vasconcellos, D'Ornellas, Bitancor — once kings of the Canaries — Da Camera, Ferreiro, Medeyras, De Freitas, whose descendants still form some of the principal families of the Island.

chivalrous nation, to engage in any adventure, whether of peace or war, which offered them the prospect of wealth or distinction; yet we still find that the prisons were emptied to supply the great bulk of their companions. It was, in fact, in many respects, a convict establishment. Dr. Fructuoso makes his boast of the inhabitants of the land of his nativity, Terceyra—many of whom had a similar origin—that they were all ancient Christians, neither tainted with Judaism nor Mahometanism; in other words, fidalgos of pure blood, and without the fatal imputation of heresy, whatever may have been the blots on other parts of their escutcheon; and a similar claim is advanced by him for the first inhabitants of Madeira; probably, the only distinction they could pretend to. It was the interest of the donatory that his lands should be promptly occupied, as the most secure means of making his other privileges really valuable; and, if we may judge from its effects, few methods of settling a new territory, have been devised, which were more completely successful, or better adapted to the peculiar characters of the occupiers, or to the habits of the period. The Island continued in the possession of the direct heirs of the original Donatories for nearly two centuries;* and, when their rights

* Gonzalves Zoigo, or Zargo, as he is commonly called, is the proper hero of the Island, and his descendants, to the sixth generation, were Captains-General of Funchal. He died in 1461; and his son, Gonzalves da Camera, nicknamed O, de Porrinha, or the Leek—the Portuguese, to this day, apply a nickname to all people, great or small—was termed, by the historian, the *espilho*—mirror—*de bons capitaès em valor e Christiandade.* He died in 1501. His successor, named

terminated, and those of the crown revived, or were re-granted in a much more limited form; some of the more obnoxious of their privileges—particularly of mills, which were sometimes grossly abused—were either abolished or suffered to fall into abeyance; and the monopoly of salt merged in the other monopolies of the crown. In the meantime, large estates were acquired by the first settlers and their descendants; and were transmitted according to the laws of the kingdom; whilst the subsequent very general cultivation of sugar, with the introduction of slaves, and the formation of large establishments, connected with it; tended still more to augment the wealth of the greater families. The ruins of many noble houses, which are found in different parts of the Island, are sufficient proof of the ample means which were at the disposal of many of their proprietors.

By the ancient laws of Portugal, a proprietor could alienate by will to a stranger, and away from his natural and compulsory heirs—namely, children or grandchildren, father or mother, grandfather or grandmother—one third part only of his possessions; and he, who had no such heirs, could dispose of the whole, at his pleasure. A custom

o magnifico, built the Cathedral, in 1520; and, resigning his office to his son, he returned to Portugal, in 1528. He died in 1536, and was succeeded by his son the first Conde de Calheta, who died in 1582. It was during his absence that the French Huguenots sacked Funchal in 1566. His son, the sixth captain, held his office for two years, only; and was succeeded by his infant son. The records to which I have had access, carry the history no further. The family of the second Donatory, Tristão Vaz, held the Captaincy for 182 years.

afterwards arose of instituting, under the authority of the church, *vinculos*, or perpetual entails, of lands and houses, upon the natural heirs, when such existed, or upon any other persons, and their heirs for ever; on condition of providing for the performance of certain masses, and distributing certain alms for the repose of the souls of the entailer and his progenitors. Whatever remained when these claims were satisfied, became the property of the possessor for life; and passed in succession to his heirs, male or female, one or both, according to the conditions of the *vinculo;* and, upon their failure, reverted to the crown. During the continuance of the entail, the estate could not be charged in any way whatever; nor let for any period extending beyond four years of the life in possession; or beyond eighteen years of the same event, with the especial consent of the heir next in succession, who claimed the rent, in both cases, when he succeeded to the inheritance. No provision could be made for the other members of the family. The estate continued, for ever, a life-possession, and a life-possession only, in the strictest sense of the term.

Provision was, however, made by the laws for granting building leases; provided the benefit which the estate received was entirely secured to the inheritance. Such grants were only resumable upon the repayment of the sums expended upon the improvement of the property; whether in the erection of buildings, or any other useful improve-

ment. They came, in fact, under the general law of *bemfeitorias*, or improvements; which will be more particularly noticed hereafter. Most of the beautiful quintas and houses belonging to the English merchants in Madeira, are held upon a tenure of this nature. They could only be resumed by the granters, upon the payment of a sum which is generally much beyond the fee-simple of the property. It was also allowable to make exchanges of lands under a *vinculo*, for others of, at least, equal value; when it could be shown to the proper authorities that the transaction was advantageous to the inheritance.

The union of several *vinculos* constituted a *morgado;* a term applied, in the Portuguese language, both to the possessor and the possession.

The effect of these perpetual entails, whether due to the influence of the church, or to the passion, so natural to mankind, to transmit their name and influence, in connexion with their possessions, to their most distant posterity; was the absorption of nearly the whole territory—which was not in possession of the crown, of the municipalities, or of charitable or religious establishments — in the hands of the *morgados*. Their further institution, however, was forbidden by a law of Don Jose the First, of the 3d August, 1770, under the bold, but generally wise, administration, of the Marquis de Pombal; who declared the system to be "contrary to the just rights of property, and to the just claims of the other members of the

family."* A still more serious assault upon the system was made by the law of Don Pedro, of the 4th of April, 1832; which allowed the removal of the entail from every separate *vinculo*, which could be certified by the proper authorities, to be less in value than two hundred dollars a year; and from every *morgado*, or union of *vinculos*, of less than twice the amount. Recent decisions of the tribunals have given a more extended effect to this law than it was probably first intended to possess; by applying it to the separate *morgados* united in the same proprietor, however much their joint amount might exceed the inferior limit of value which it imposed. The effect of this law is already beginning to be felt in sales of land to English and other capitalists. So rapid, likewise, of late years, has been the depreciation of the value of wine—the staple produce of the Island—that very few estates will be long exempted from its operation.

It is difficult, in the absence of statistical details, to ascertain the quantity of land which is under the operation of the *vinculo;* but I should conclude, from the best information which I could procure, that it still embraces nearly four-fifths of the cultivated lands. There is some land—but not of great extent—belonging to three convents of nuns, the only religious communities which survived the revo-

* "Contraria ao uso honesto do dominio que o proprietario tem pro direyto natural, contraria á justica e a igualdade con que esses bens deveriam ser repartidos sobre os filhos."

lution of 1821; a small portion ~~of which~~ belongs to the Hospital of Funchal; and some is in the possession of the crown. There are, also, some customary freeholds, held by the peasants in the mountains; but the greatest part of the mountain pasture is the property of the municipal bodies, or *cameras*, of the different parishes; and is commonable by all the occupiers of lands within their limits. So defective, however, is the execution of the law, in every part of the Island, that all those districts are treated as common property—whether for pasturing cattle, or collecting fuel, by cutting furze, broom, brushwood, or timber—without any system or control. It is from this cause, that the forests in the mountains are rapidly disappearing, without a chance of being replaced by new timber; for the goats and cattle, which are allowed to wander everywhere, without restraint, effectually destroy the young shoots as soon as they may appear.*

The *morgados* possessed country houses, sometimes of great extent and magnificence, and always with a chapel attached to them, where the masses, required by their deed of foundation, were usually performed. They expected and received many acts of homage from their tenantry; who were accustomed to regard them as their masters, or feudal lords.† They brought offerings of their produce upon

* Great complaints were made upon this subject when I was in Madeira; and many projects were proposed and discussed, for the purpose of preventing these depredations. The provisions of the law are amply sufficient for the purpose, but they are not enforced.

† It is still usual for the *caseiro* to address his morgado as "meu amo," or "my master."

his marriage, or upon the birth of his heir. They brought fowls to him at Christmas, eggs at Easter, and a portion of the head of every pig which they killed. If he removed from his country to his town house, they bore his hammock—for there are no carriages in Madeira,—and his baggage. Such services, however, were rendered rather from custom, than from right; and might be considered as originating in those spontaneous feelings of kindness and respect, which connect, or ought to connect, a landlord with his tenants. The revolution, however, of 1821 produced a violent disruption of these relations between the rich and the poor; and swept away every vestige of feudal feelings and feudal times; whilst the subsequent occupation of the Island, by the Miguelite party, during several years; and the forced expatriation of many of the principal *morgados*, who had favoured the constitutional side; led to the very general neglect and ruin of their country residences; and to the obliteration of the few vestiges of the influence which they had formerly possessed. The rapid fall, likewise, of the price of their wines, which began about the same period, reduced their incomes far below the scale of expenditure which most of them had adopted in more prosperous times. During the time of the war and the English occupation, when the Island was the resort of the East Indian fleets, ships of war, and convoys; wine, and almost all other articles of produce, sold for more than double their present prices. The proprietors began, in consequence, under the

pressure of their necessities, to anticipate their revenues, by selling, in many cases, the reversion of their crops, for several years to come, to English and other merchants. The effects were equally ruinous to themselves and to the progress of improvement; they became more and more severe in their exactions from their tenantry; their residence in their country houses became neither convenient nor safe; and they have since very generally abandoned them.

The *caseiros*, or occupiers—the successors of the Roman *coloni*—hold their lands, universally, upon the *metayer* system; where the gross produce, after the deduction of the tithe, is divided, equally, between them and the landlords. They build their own cottages, and the walls of rough masses of basalt, or tufa, which surround their occupations, or support their soil; and they plant their own vines, chesnut, orange, peach, fig, and other fruit trees. If water be brought to their lands from the *levadas*, or public water-courses, it is at their own expense. Whatever, in fact, is necessary to bring their land into profitable cultivation, is done by the *caseiros*.

These improvements, or *bemfeitorias*, as they are called(—for though there is a distinction between them in law, there is little or none in practice—) provided they are useful, or even when they are not so, are the absolute property of the *caseiro*, who cannot be removed from his occupation, until the landlord has paid him the full value, as ascertained by two valuers, one appointed by each party.

They are usually selected from public valuers, nominated by the *camera*, or municipality of the district, who, for the most part, adopt a recognised scale of prices: thus so much is for a cottage, a cooking house—usually detached—a shed for cattle or pigs; so much, a *brasso*, for walling; so much for every tree, vine, or other production which cultivation has introduced. The value which is thus assessed, far exceeds, in most cases, the real or marketable value; such, for instance, as the *caseiro* would obtain if he should sell them, as he is enabled to do, with or without the occupation, to an indifferent person; and it is only in very rare cases that the landlord becomes the purchaser.

The effect of this regulation is to give to the occupier and owner of the *bemfeitorias* a nearly perfect fixity of tenure.

The other relations of the landlord and tenant are regulated almost entirely by the law, or rather by the custom, of the country; and rarely by special contract. Leases between a peasant-occupier and his landlord are entirely unknown. Money-rents are beginning to be introduced, though to a very limited extent, on the north and west of the Island; where agriculture has made greater progress, than in the south, and are also adopted by some few English proprietors; but in all other cases, the landlord takes one-half of the wine as it issues from the wine-press;* one-half of the corn, when trodden out

* A factor attends for the purpose, and superintends the whole process. The wine is taken from the wine-vat in skins, and carried to the store of the landlord or merchant.

by oxen on the public threshing floor,* as well as one-half of the straw itself; one-half of the sugar-cane, fruits, garden or other produce; one-half of the grass, or of the various compound of weeds, branches, cuttings of vines, and other produce, which is sold as grass, and not consumed on the premises. It should be remarked, however, that before this division is made, the tithe of all the produce is claimed by the officers of the government, to whom, and not to the church, it is paid in kind.

The most liberal landlords either give the seed entirely, or advance it to the *caseiro*, and reclaim it from the gross produce before the division is made.

They rarely exact the less considerable articles of produce, except when they are very needy, or have leased their claims—as is the case with some of the largest proprietors—to a *rendeiro*, or *middle man*; when they exact their rights with great strictness and severity. It is not unusual, also, before the harvest takes place, to arrange with the *caseiro* the amount of corn or other produce which they shall claim, or the price to be paid for it; leaving all the risks with the occupier; who is rarely, however, in a condition to make a money payment.

* One or more threshing, or rather *treading*, floors—for the flail is unknown—are provided in every district; generally, on some eminence, and, often in the most picturesque situations, in order to enjoy the full benefit of the wind in separating the chaff. The sheaves are borne on the backs of the peasants, the usual substitutes for beasts of burden. It is hardly necessary to add that the Mosaic injunction, "Thou shalt not muzzle the ox that treadeth out the corn," is not observed.

The profits of the cattle, sheep, pigs, and poultry, which are fed on the farm, belong entirely to the *caseiro;* and if all its produce was devoted to their maintenance, the landlord would be entirely ousted from his income. It is true that a landlord has the power of enforcing, by a process of law, the customary and profitable cultivation of a farm; and of punishing a tenant who, as is very commonly the case, neglects it altogether; yet the administration of the law in Madeira is so dilatory and vexatious, that the remedy is generally considered, there, as well as elsewhere, much worse than the disease. If a *caseiro* is too poor, as, indeed, he generally is, to provide cattle for feeding; they are furnished by the landlord, or by other persons, at a price agreed upon; the profit being divided when they are sold. If they sell for less than they cost, or should they die, the loss falls upon the owner, and not upon the occupier. Cattle of all descriptions are stall-fed, unless pastured upon the mountains. There is no pasture in the lower country, and no clover or artificial grasses; the soil being either unfavourable to their cultivation, or no proper attempt having been made to introduce them. It is probably owing to the fact, that the condition of the tenure of land is more favourable to the breeding of cattle, than to the cultivation of crops, which must be divided with the landlord, that we find the supply of oxen so abundant. They are the only beasts of draught, horses never being employed for that purpose. They are of a breed, peculiar to the

Island; sometimes, extremely small, but very active and hardy; and yielding beef of a very superior quality. The sheep are few in number, and, for the most part, are so poor and emaciated, that the Island mutton is hardly eatable. Every cottage has its pig; but the pork of a warm climate, when the animal is not fed in the forests, is not altogether free from the imputation of uncleanness. Poultry of all kinds is very abundant; and furnishes one of the most constant and certain sources of profit to the peasantry.

When the vines are mature, and the corn is ripe, the *caseiro* gives notice to the landlord, whose factor, attends at the wine-press, or the threshing-floor, and superintends the division of the produce. The law, in fact, forbids the removal of any important article of produce from the land, without such previous notice; but arrangements of a less vexatious kind are usually made with respect to those which are of inferior value.

It is during the periods of vintage and harvest that the most vigilant attention is required to the proceedings of the occupiers, as the grapes may be abstracted from the vines, and the ears of corn cut from the stalks; and both concealed or sold. If the factor, who watches the interests of the landlord or the middle-man—*rendeiro*—is too minute in his inspection; he is threatened, and in some cases, though very rare, he has been murdered. If a landlord resides upon his estate, and exercises too close an inspection of the productions of his

tenants; he is subjected to annoyances and losses, which render his continuing among them uncomfortable, at least, if not dangerous. Such consequences may naturally be expected when a kind and confidential feeling does not exist between the landlord and tenant; and when so many opportunities present themselves for the practice of frauds, which it is equally difficult to prevent or to detect.

The *caseiro* cannot grant a lease of his *bemfeitorias;* and cannot let his occupation, without the license of the landlord; nevertheless, upon giving notice of the sale, which, however, is rarely thought of or required, he can dispose of them; which is equivalent to a transfer of the occupation. If he dies, his children succeed to the inheritance in common, and either divide it—building cottages upon their separate portions—or occupy it together; for it rarely happens that one of the number possesses sufficient money to buy up the rights of the rest.

The *bemfeitorias* may be sold to a third party, who is neither landlord nor occupier, but a voluntary purchase of such a property is rarely made; as its profitable tenure is not separable from the occupation, unless a tenant should consent to pay rent for it, which is rarely done, as the landlord alone possesses any real hold upon him. They are, however, very frequently a compulsory purchase, for the payment of the debts of the occupier. Upon the institution of a process for the recovery of debt, the property of the debtor is appraised by two valuators, appointed by the municipality of the district, and is

offered for public sale, at the prices, returned, after they have been publicly advertised. If the bidding reaches, or surpasses, a sum which is within 20 per cent. of the valuation, it is sold, and the money applied to the discharge of the debt. If, on the contrary, it falls short of it; then the property, whatever it may be, whether *bemfeitorias*, lands, houses, or goods of any description whatever, is transferred to the creditor in discharge of a portion of his debt, which is less, by one-fifth, than the price affixed to it. By this unhappy provision of the law, money debts are not necessarily recoverable, as money; but in a form which hardly possesses a negotiable value; especially, in the case of *bemfeitorias* on land, which are valuable to the landlord or the tenant; but which possess little value, apart from them; for, if the owner of the *bemfeitorias* should place a tenant in the occupation of the land, he could not seize the produce as a security for the rent which he would claim for them. It is the landlord, alone, when in possession of the *bemfeitorias*, as is sometimes the case, who would be in a condition to do so. *

The occupations of the tenants are, in general, extremely small. In the richer, and more productive districts, they rarely reach an acre of ground —much more frequently, not one-half, or even one-tenth of that quantity. There is, in fact, hardly any limit to the extent of their subdivisions. The late

* There is no country in Europe where the security for debts is so imperfect as in Portugal; in consequence of this provision of the law, designed for the protection of the debtor against a wasteful sale of his goods.

Conde de Carvalhal, the owner of the Palheiro, and of nearly one-third of the Island, had more than eight thousand tenants. If we suppose the other two-thirds to have been equally subdivided, there would be twenty-four thousand tenants in Madeira, out of a population of less than one hundred and twenty thousand. This calculation appears somewhat excessive, as, according to it, it follows that five out of six males, of mature age, must be occupiers of land; but almost every artizan, *burroquero* — horse-keeper — servant, or other person of the lower classes, in Funchal, whatever be his calling, is in possession of one of these minute occupations; where he grows his garden-stuff, a few vines, fig or peach trees, a few sugar canes, sweet potatoes, and sometimes wheat or barley, in a patch often not exceeding the size of an ordinary flower bed. They are very rarely carefully or laboriously cultivated, being generally over-run with weeds; while the different articles of produce are intermixed with each other, without the least attention to their peculiar habits, or proper treatment. In Funchal, a city of gardens, there is not one in twenty, which, within and without its walls, exhibits the least pretensions to cleanliness, neatness, and order.

As we recede further from the towns; though some of the occupations are enlarged, yet others are subject to the same negligent and miscellaneous cultivation. There is no system; no careful and continued labour. We see, everywhere, a confused medley of every species of produce. There is no

selection of seeds—no seeking new and improved kinds of vegetables or trees—no grafting, and, therefore, no superior fruits—no proper pruning—no system—no knowledge. What their fathers have done, they are content to do likewise; and reject, with characteristic obstinacy, all proposals for new and more efficient methods of cultivation.

The vine, alone, on account of the great value and importance of its produce, is ~~cherished~~ with care and system—though, even here, we find the same obstinate adherence to old modes of training and pruning. The vines are planted in deep trenches, and, generally, much too near to each other. When of sufficient height, they are trained upon a net-work of canes—*arundo sagittata*—extensively grown for this purpose, crossing each other, at about the distance of two feet, tied together by twigs of red willow—*salix rubra*—and supported by posts, or stone pillars, at heights from the ground, varying from four to six feet. Vegetables, beans, and weeds of all kinds, are allowed to grow beneath this trellis-work, in the winter season; but are, generally, very carefully removed, or buried in the soil before the foliation of the vines on the approach of summer. It is a necessary effect of this system, that the pruning—*a poda*—of the vine, takes place, not *to*, but *from* the root, so as to add, every year, to the length of the ancient stem, through which the circulation is conducted; and which, from decay and diseases of various kinds, becomes more feeble, instead of stronger, with the increase of age. At the end of

little more than twenty years, a vineyard should, generally, be destroyed and replanted; but, here, it is frequently maintained until it becomes comparatively unproductive. The fruit, also, decreases in flavour and richness, the further it is removed from the ground—a fact which the French and German wine-growers fully understand, and consequently, have adopted a totally different system.

Nearly every garden in and around Funchal, and in the more favoured localities, however small it may be, is partially occupied by vines. Large tracts, also, when the soil and aspect are peculiarly favourable for them, are occupied by vineyards exclusively. The vineyards, themselves, are seldom of great extent, the largest not exceeding three or four acres. They are rarely cultivated by the proprietors, unless in gardens attached to their *quintas*, but almost always by *caseiros;* the same division of the produce prevailing in the richest and the poorest vineyards. The produce varies from one to three pipes, per acre. The price to the producer, during the year 1848, varied from forty dollars, in the best districts, to ten or twelve dollars, per pipe. Towards the end of the last war, the price was nearly three times as much.*

The grapes, in their progress to maturity, are exposed to a variety of enemies. Aided by the rats and bees, an innumerable multitude of lizards, which harbour in the hot walls of loose basaltic stones,

* The prices of the Madeira proper, in the year 1848, per barrel—of which about fourteen make a pipe—in *milreis*, or dollars—4s. 2d. nearly—were at—

which surround the vineyards, are said to destroy at least one-sixth of the produce. Those which are allowed to hang until they are perfectly ripe, produce the richest flavoured wines, and the merchants will frequently double the price, per *baril*, for wine, made from grapes thus preserved. But, when the grapes of the neighbouring vineyards are gathered, the enemy crowd to the plunder of those which remain; and which must be speedily secured to save them from almost total destruction. One of the reasons for the high price of the Malmsey, is said to be the fact, that its vintage is somewhat later than that of the other wines.

When from its nature the soil is not suited to the vine; or when it lies at a height too great for the maturing of the fruit; wheat and barley are the favourite articles of cultivation. Almost the only instrument of cultivation is the *enchada*, a slightly-incurved pick-axe which the peasants use, with great dexterity, to break up, rather than upturn, the surface of the soil; which, being generally light and

	1st quality.	2nd quality.	3d quality.
Sta. Luzia, in or close to Funchal	Rs. 2,800	1,800	1,300
San Antonio and San Martinho, 1 mile west of Funchal	2,400	1,700	——
Estreito, 4 or 5 miles west of Funchal, near Cama dos Lobos	2,800	2,000	1,500
Campanario, 7 miles west of Funchal	2,200	1,800	1,500
Curral (a very profound valley, surrounded by the highest mountains)	900	800	——
Calheta, on the west of the Island	1,300	1,100	900
Porto Moniz, on the north-west of the Island	1,500	1,300	1,000
Malmsey, from the Paul do Mar, (Fazenda dos Padres)	4,200	——	——
Sercial, from the Paul do Mar	3,000	——	——

friable, rarely requires the careful trituration which is necessary in other countries. Most of the occupations are too small, and, in most cases, too precipitous, to allow of the use of the plough. The instrument which passes under that name is entirely of wood, and of the rudest form; and is drawn by two oxen, kept six or seven feet, asunder, by a long clumsy wooden yoke—*junta de bois.* Ill-adapted to its purpose as this strange apparatus may appear, we frequently see it used on acclivities, so steep, as to induce an apprehension that the whole system—oxen, ploughman, and plough—may be precipitated, together, into the ravines. A machine like this loosens, without upturning, the earth; and, when used, as is very generally the case, in the heavier clayey soils, serves to effect no very essential object in cultivation. Weeds, which spring up spontaneously in this prolific climate, whenever moisture, natural or artificial, stimulates their growth; are rather treated as an article of produce, than as nuisances, to eradicate which all the labours of the husbandman should be applied. They are collected, with other vegetable products, whether cuttings of vines, or branches from the banana, sugar-cane, and other plants and trees, and are brought to market and sold as food for horses and cattle. They are removed, as we have before observed, in the summer season, from the spaces between the vines; but in the wheat crops, and elsewhere, they are allowed to flourish, undisturbed.

There is not only no rotation of crops, but in

large tracts of land there is hardly even any change of cultivation. As in the neighbourhood of Santa Cruz, wheat and barley have been grown in the same lands, from year to year, beyond the memory of the present generation. The manure saved from feeding their oxen and pigs, and which is not wanted for their garden produce, or vines, is applied elsewhere in very insufficient quantities; but whatever quantity is made on the land must be consumed on the land; the *caseiro* not being allowed, like the landlord, to sell or remove his portion of the straw. Artificial manures of all kinds are unknown.

The crops which are produced are such as might be expected from a system of cultivation so rude and improvident. I endeavoured to obtain information, respecting the average crop of wheat per acre; but without much success. Of those which I saw on the ground, I doubt whether the most abundant would have exceeded eighteen or twenty bushels. The average, as far as I could learn, does not exceed eight or ten; many of the crops which I saw, would have been abandoned in England, as unequal to the repayment of the expenses of reaping and harvesting. The ordinary produce of rye, on the mountains, does not exceed six or eight bushels an acre. In the west of the Island, between Calheta and Porto Moniz, where the separate occupations are larger, and where the level character of the ground allows of the use of wheel carriages; the produce is said to be much more considerable. The same is affirmed of the neighbourhood of San Vicente, and Santa

Anna, in the north, where the people are more industrious; and where some of the more intelligent proprietors have successfully introduced better methods of cultivation, and new articles of produce—more especially Indian corn—which not only forms the ordinary food of the people, but the growth of which is admirably suited to the climate.

The occupiers of land, in Madeira, possess, therefore, through the operation of the *bemfeitorias*, a nearly perfect security in the maintenance of their tenure. They are practically, though not theoretically, independent of their landlords; their course of cultivation is very rarely controlled. Even if their land be allowed to run to absolute waste—though, for obvious reasons, it is never altogether abandoned—the landlord seldom seeks to enforce the law, and eject them; so slow is the machinery which must be put in movement for that purpose. Nothing, in fact, is more common, than to find occupations *almost* entirely uncultivated, even in some of the most favoured localities. The tenant may be idle and improvident, or engaged in other occupations; but, as long as the purchase of the *bemfeitorias*, according to the tariff, is interposed between him and the landlord; even though they may be nearly worthless, both to himself and to others, he may venture to defy him.

I believe the peasantry are fully sensible, not merely of the extent of their rights, but also of the value of their independence. When sufficiently fed, they are generally a fine and vigorous race of men.

They are very courteous and obliging, never passing each other or a stranger without a salutation. They are capable of sustaining great fatigue; more especially in bearing burdens on their heads, for great distances, and over the most difficult roads. A *burroquero* will keep up with a horse for a whole day, merely holding by its tail in the steeper ascents, and bearing, at the same time, corn and meal for the animal, and the baggage of the rider. Yet, though thus capable of great and long-continued exertions, the people are not steadily and systematically industrious. They are disposed to neglect their work, when not strictly superintended; they are wanting in that great principle of *integrity in labour*, which obtains, when work is done almost equally well, whether under the eye of a master or not; and which is the true test of industry in the working classes, and the true foundation of the wealth and prosperity of nations. Nor is this their only fault. They are singularly averse to changes and improvements of every kind. They will do what their fathers have done. If new and improved tools are offered to them, they neglect, or refuse, to use them; if new and more efficient methods of cultivation are proposed to them, they return, when left to themselves, to the routine to which they have been accustomed; if taught new methods of training and pruning their vines,* they will hardly practise them

* Mr. Veitch has attempted to teach the principle of pruning the vine, not *from* but *to* the root, but with little or no success; no native occupier would practise it. Of all the agricultural tools which he attempted to introduce, the garden rake was the only one which his labourers were willing to adopt.

for others, much less for themselves. They rarely attempt to raise themselves, by superior industry or providence, above the condition of their neighbours; but generally, rest contented, with the absolute necessaries of life, and will make no long-continued exertion, to secure its comforts or luxuries.

The *metayer* system is very unequal in the return which it gives to labour. The payment of one-half the produce, in addition to half the tithe, may not amount to more than a moderate rent, when the land is naturally rich and well situated, yielding wine and other valuable produce; but, under less favourable circumstances, it becomes excessive, in comparison with the cost and labour of cultivation. The effects, however, which are observed to follow from such inequalities in the remuneration of labour, are not altogether such as might very naturally be anticipated; for, though the first class of occupations are more carefully cultivated than the second, the difference is not generally very marked and unquestionable; so much depending upon the habits and character of the occupier. Where money-wages are rarely paid, except at a few busy seasons of the year, and where much time is usually spent in idleness, or very irregular employments; there seems to be no sufficient estimate, formed, of the value of labour; and, consequently, there is no proper standard of comparison by which they can adjust the amount of their exertions to the return which they are likely to yield.

Much, also, depends upon the usual habits and

condition of the people, in the class to which they belong. Very few of their number ever save a sufficiency of money to raise them above their fellows; or secure, by industry and perseverance, I will not say wealth, but even a competent independence. There are also very few openings for the investment or accumulation of the produce of their industry. They can rarely buy land, apart from the *bemfeitorias,* with which it is encumbered: there are no banks for savings, or banks of any kind: there can be no mortgages on land which is under the *vinculo;* and the condition of the Portuguese law, and the habits of the people, render loans of all kinds unsafe, more especially with government security. We, consequently, find that the peasantry, whether as the result of habit or calculation, usually invest their savings in jewellery; principally, chains of very pure gold; to which a link is added, when there is money to spare; or taken away when money is to be raised. Of all methods of investment, this is one which is the least favourable to the growth and accumulation of wealth.

The system, which we have been describing, seems to remove all preventive checks to the increase of population. The sub-division of an occupation, either during the lifetime, or at the death of the father, affords, to all his sons, a site for a residence, at least, if not sufficient means of subsistence. A few days suffice to build the walls of a cottage, of the rough masses of basalt, which half cover the surface of the country, and to bind together a few rough poles, as

a support to a roof which is thatched, very skilfully and securely, with straw. We thus find such habitations rising up like mushrooms in every part of the cultivated grounds; and in some districts—as near Santa Cruz, and in the Vale of Machico—they present themselves in such vast multitudes, when compared with the means of production and employment around them, as to indicate too clearly the exuberant growth of the population. I have no where seen, not even in the worst parts of Ireland, more intense misery than amongst the people of this Island. A stranger is assaulted, whenever he appears near those destitute and over-peopled districts, with crowds of mendicants, whose emaciated and diseased appearance shows too plainly that their food is insufficient and unwholesome. I have shuddered to hear the account of their sufferings, which has been given me by those who had good opportunities of observing them.

We have, hitherto, confined our attention to the occupiers of land in Madeira. We shall, now, proceed to consider the general character and condition of the proprietors. Some of the *morgados*, who have not been impoverished by their own improvidence, or by political troubles, are still rich and prosperous. They succeed to their estates without responsibility for the debts of their predecessors, and without mortgage, or incumbrance, for the support of other members of their family. Still, the certainty of his succession to the estate, as the heir in entail, encourages the anticipation of his revenues;

and leads him to incur debts which, very commonly, diminish his resources. He is, also, the acknowledged head and protector of his house, and, though not compelled to provide maintenance for brothers, or dowers for sisters, he rarely attempts to escape the obligations which his position, as well as a sense of natural justice and affection, impose upon him. The rapid depreciation, also, which has taken place, of late years, in the price of the great staple commodity of the Island, has very materially reduced the means, at the disposal even of the richest proprietors.

The *morgado* has only a life estate, and has rarely the power, if he had the wish, to improve it. His tenant is nearly independent of him; and is the sole proprietor of all the improvements which occupation and cultivation have given to it. He cannot interfere, except in very rare cases, with the cultivation; and must be content with that portion of the produce which the law allows him.

The vast number of separate occupations which these estates very commonly embrace, and their wide separation from each other, render it necessary, in many cases, to lease to a *rendeiro*, the rights of the proprietors; and thus to abandon the power, if they had the disposition, of treating their tenants with liberality and kindness. The late Count de Carvalhal, the richest proprietor in the Island, was accustomed, when not in banishment from political causes, to spend a great part of his very ample fortune, in employing the people in his gardens at the Palheiro, or elsewhere, at liberal wages; with a view

of generating amongst them habits of industry and prudence, and an increased taste for the decent comforts of life. But the guardians of his heir, a minor, resident at Lisbon, have leased such of his estates, as they have not sold, or dissipated, to a gentleman of wealth and influence in Funchal; who is compelled, by his position, to exert very rigorously the rights which the law allows him. It is very unfortunate for the well-being of the Island, that the state of the law, as well as the impoverished condition of many of the principal proprietors, should have made this unhappy case more nearly the rule than the exception.

Amongst many other political reforms, the entire abolition of the *vinculo* or entail—the completion, in fact, of the work begun by Don Pedro—has lately occasioned no small degree of discussion. It is urged with great earnestness, not unmixed with much exaggeration, both of language and statement, in a pamphlet,* which was published during my stay in Madeira. Speaking of the times which preceded the revolution, when the wines still maintained the high prices which they had acquired during the last war, "The *morgados*," says he, "cared not for any other species of cultivation; they reposed their heads upon their sofas; they slept the sleep of indolence, or awoke to spend their riches in the midst of the most scandalous luxury. Agriculture was left to the ignorant *colono;* who knew the culture of the vine

* "Breves Reflexiones sobre a abolicão dos morgados, na Madeira." Par A. C. Heredia. 1849.

only, and that very imperfectly. Being compelled, very generally, to emigrate during the usurpation of Don Miguel, they found themselves ruined men, upon their return; as the culture of the vine is now, both for the *colono* and proprietor, an affair of cost rather than of income. For, if we reckon up the expenses of planting, pruning, caning, trenching and irrigating the vines; of gathering the fruit, and keeping up the walls to protect the soil from being carried away by the violent rains; of giving the tithe to the government, as well as paying various fees and taxes previous to exportation; it will be readily seen that little remains for the poor cultivator; whether in compensation of his labour, or of the cost of his improvements. The landlord, again, receives but a small price, if he sells his portion of the produce to the merchant; or, if he fails to do so, as is very commonly the case, and is compelled to transfer it to his stores; then come in successive expenses of casks, store-room, pouring from cask to cask, brandy, the stove*, and other charges; all which absorb, in less than two years, more than half the value of the wine." The language of agriculturists and wine-growers, however, is much the same in all countries, at all times. They are always on the brink of ruin.

The *colono* then is too ignorant, and the proprietor is too poor, to devise new modes of culture, by which that of wine may be replaced; or to defray the expenses which must be attendant upon such

* The wines are placed in an *estufa*, or stove, at a high temperature, in order to give them a premature ripeness and maturity.

a change. What, then, must be done? "Abolish," says the author, "the *morgados;* and you will see agricultural credit and prosperity re-established. Abolish the *morgados*, and you will see the proprietor in possession of ample means for the culture of the land. Do this, and you will see the people, living in abundance, instead of misery; the proprietor, rich, who before was poor; the population, which famine had previously tended to annihilate, increased."

A more sober examination of the probable effects of such a measure upon the prospects of agriculture, and upon the condition of the people; would not lead us to expect a revolution so rapid and so decided. The first effect would probably be a very great increase in the number of proprietors; the second, the conversion of proprietors into cultivators, through the purchase of the *bemfeitorias;* and the third, the progressive introduction of money-rents, payable by a higher and better-instructed class of occupiers. Unless, in fact, the influence of the proprietor can be directly brought to bear upon the cultivation of the land; it is not probable that much improvement can take place in the condition of the cultivation. In other words, the landlord must not only have an interest in the most productive cultivation of his land; but also some reasonable power of enforcing it, by displacing a negligent and ignorant tenant.

The change produced would probably be very gradual. If monied men, tradesmen, or others, become

proprietors, they would, in many cases, become occupiers also, by the purchase of the *bemfeitorias.* The possession, also, both of greater knowledge, and of greater means, would lead to the introduction of better methods of cultivation; and these would serve as models of instruction, which, in process of time, the more intelligent and enterprising of the *caseiros* would be disposed to follow. Much more might be effected, if the system of money rents should replace the division of the produce. Such rents, if the payment of them were capable of being promptly enforced, would be equally advantageous to the landlord and the industrious tenant; and would supersede a machinery of factors and middlemen, which is at once costly and oppressive.

Still greater advantages would seem to be offered by another method of conversion; which is, to enable the *caseiro* to become the owner, whether by purchase, or by a perpetual rent-charge. In a country, so over-peopled as Madeira, whose inhabitants are almost entirely supported by rural labour, it is impossible to supersede small occupations by combining them into considerable farms. The character of the country, also, which presents, within the compass of a few acres, great varieties of soil and aspect—both admitting the most varied cultivation—is opposed to any scheme of extensive and indiscriminate combination. One portion is suited for vines; another for garden produce; another for fruit trees, coffee, or the sugar-cane; another for wheat or Indian corn; and, therefore, to superintend growth,

so diversified, requires an amount of skill and experience which are not likely to be found united in the same person. The object, therefore, of wise legislation would be, to encourage the distribution of the land into occupations which would possess a unity in their product, sufficient to secure the greatest amount of skill and capital in respect of cultivation, as well as to provide the most profitable employment of the greatest number of the people; and, with this, should be combined, if possible, such provisions against further extreme sub-divisions, insufficient to give either support or employment to those who hold them.

The last condition above noticed, is not easily secured, without some recognition, as in England, of the law of primogeniture. Let the eldest son take the land, and its accompanying appurtenances, where the father makes no other provision by will. The necessity of making a will, in order to prevent the operation of the law in case of intestacy, would compel the attention, even of the most ignorant owners of land, to its capacity to support more than one family. If he has received it entire from his father, he will wish to transmit it entire to his son. The pride of possessing property, and transmitting it unbroken, whether inherited or acquired, is implanted for wise purposes in our nature. It is desirable, also, that the younger sons should not reckon upon the division of their father's land, as their only means of support, but should be taught to look, even from their earliest years, to other occu-

pations. Much, in all such cases, will depend upon the habits of the population, and the feelings with respect to their equitable rights, which have been generated by ~~language.~~ If it be the custom, that all the children inherit the real, as well as personal, property of the father, where no express provision, by will or settlement, is made to the contrary; there are few fathers who would venture to contravene it; but, if the law of the land should make a different arrangement; one which could only be set aside by a formal act; not only would the relation of dependence of the children upon their father be entirely changed, but all parties would be compelled to look boldly into the future, and to make timely provision for securing support, whether from their own exertions, or from other sources.

Again, if the occupier of land is not the owner, but a simple *colono*, as at present; it seems equally expedient that provision should be made for securing the occupation against further subdivision, without the express consent of the landlord. For this purpose, it would seem necessary that the *bemfeitorias* should pass entirely to the eldest son, when no provision is made by will to the contrary; or that they should be compulsorily sold, and the occupation made to follow the purchase. The feelings and habits of the people would probably be found to be so much opposed to the first of the suggestions above mentioned, that it would not be prudent to attempt to give it the force of a law; but the second is one which would tend to settle many disputes that arise

constantly amongst the peasantry; as well as to check that rapid subdivision of land, which is covering the most fertile districts of the Island with a network of pauperism.

It might tend also to promote this salutary and necessary reform, if the holders of lands under *vinculo*, even if not otherwise enfranchised, were enabled to mortgage their estates, as far as might be necessary, but no further, for the purchase of the *bemfeitorias;* so as to secure the absolut econtrol of the occupation. There can be no doubt, that the enfranchisement of the *morgados*—provided it could be effected consistently with a due regard to the just interests of the heir, presumptive or apparent—supposing the remoter expectants under the entail to be disregarded—would contribute greatly to the multiplication of the number of proprietors; and would bring capital to bear more immediately upon the cultivation of the land. It is only by the union of the owner and the occupier—which very rarely takes place except amongst the English proprietors*—that we can expect to see the land cultivated upon a scale and upon a system, which can really test its productive power. It is only by the example which can be afforded by such superior cultivation, that the ignorant *coloni* can be induced to adopt improved methods; so as to be rescued from the state of almost helpless poverty by which they are now so generally depressed.

* Senor D'Ornellas occupies an extensive mountain tract, near Funchal, which he has covered with beautiful pine woods, without a single *colono*. Such examples are, unhappily, very rare.

It would be impossible, however, to make any effectual progress towards the consolidation of the smaller holdings, without the aid of very extensive emigration; for it may be assumed, that the smaller occupiers would continue to cling to them, with desperate tenacity unless they were provided with other places of abode, or other means of support. The most cursory observation is sufficient to show the correctness of the opinion, which we have elsewhere expressed; that the present numbers of the people are excessive, whether we regard the amount of labour which the most careful cultivation of the land would require, or the amount of produce which it is capable of yielding. When Dr. Kalley, about five years ago, was violently ejected from the Island, his numerous converts, who, with singular constancy, adhered to the new faith which they had adopted, with very few exceptions, emigrated to the West Indies and North America, that they might escape the system of petty persecution to which they were exposed. The movement, which was thus began, speedily extended to large numbers of the people; and was only arrested by the forcible interference of the government. The experiment, thus tried, turned out unhappily, as far as the West Indies were concerned; and great numbers of the latter class of emigrants, though none of the former, have since returned to the Island. If the authorities had been influenced by wiser views, at the time this passion for emigration prevailed; they might have succeeded in securing such a reduction of the population,

as would have given to those that remained, ~~both~~ with the aid of better laws, and a more efficient administration of them; ~~thus providing~~ not only sufficient employment, but also sufficient support. Additional means of employment might also be provided by changes, not merely in the modes, but in the objects of cultivation. In many districts, Indian corn and rice, which require very careful cultivation, might very advantageously, either entirely replace, or alternate with, wheat and barley. The growth of sugar might be greatly extended, though, as an article of export, it could hardly compete with the slave sugar of the Brazils. The coffee and arrowroot of the Island are of first-rate quality, and deserve much more attention than they now receive. The cotton plant has never been tried, though the climate seems well adapted for its growth. The cochineal insect, and the peculiar cactus on which it feeds—the gathering and cultivation of which form so profitable and extensive a source of employment in Teneriffe—have been attempted in Madeira; but the experiment was abandoned, though after a very insufficient trial. Fruits of all kinds, if continued, not by seed, as at present, but by carefully-selected cuttings and grafts; might become, when dried, or preserved, a very important article of export. For these and other purposes, however, the government should establish, near Funchal, and in the mountains, model gardens, from whence plants, trees, and seed might be cheaply supplied; and where experiments on new articles of production, and on

new methods of cultivation, might be tried and exhibited. Such an institution, if well managed and liberally supported, could not fail to assist materially in developing the resources of the Island.

There are other reforms of a simple and practicable nature, which might be suggested, and which would, likewise, tend materially to promote its welfare. Such would be the establishment of an efficient rural police, to secure the more general enforcement of the law. Such would be the transfer of the administration of the roads from the municipalities to some central authority; a measure, which would not only secure the completion of the great lines of communication across the mountains and along the coast; but likewise maintain them, when made, in constant repair. Such would be the establishment of banks for savings; and of a public bank of issue and deposit, with sufficient guarantees for their security and good management. Such would be a change in the law of debtor and creditor, which would secure the latter against fraud and evasion. And such, above all other reforms, would be the introduction of a rational tariff; with a system of import duties, so regulated, as to put an end to the scandalous smuggling which is now openly practised, almost with the connivance of the custom-house authorities; and which is not only ruinous to the revenue, but tends to perpetuate a system of corruption, that degrades the character, and destroys the efficacy, of nearly every officer of the government.

PART V.

HISTORICAL AND DESCRIPTIVE ACCOUNT

OF THE

ISLAND OF MADEIRA,

AND

GUIDE TO VISITORS.

BY JOHN DRIVER.

CHAPTER XVII.

DISCOVERY OF MADEIRA.

The Island of Madeira was first discovered by the Portugese in 1419. The discoverers were João Gonzalves Zargo, and Tristão Vaz Teixeira, who were, in consequence, made *Fidalgos* by the King of Portugal, and had the Island given them to preside over, divided into two districts; Zargo settling at Funchal, and Vaz at Machico. The Island was named "Madeira"* from its appearing as one immense forest. Zargo set fire to the wood, to clear the land for agricultural purposes, and all writers agree that it burnt for seven years; at one time obliging the colonists to take to their boats for safety.

The following description of Madeira, on its first discovery, is translated from a MS. by Dr. João Pedro de Freitas, now in the possession of my friend Illmo. Senor Manoel de Santa Anna e Vas-

* *Madera* in Portuguese signifying *wood*.

concellos. "The Island of Madeira, at the period of its discovery, presented a most lovely picture of nature. A vegetation truly astonishing covered it with indigenous and infructiferous plants, for the most part unknown in Europe, and growing to a prodigious height. The ancient and majestic cedar, the laurel, til, vinhatico, azevinho, aderno, teixo, pão branco, and dragon tree, intermingled with those beautiful shrubs, the folhado, faya, urze, myrtle, and uviera; and forming, thus, one continuous and impenetrable forest. The thicket was carpeted by innumerable and diversified plants, some odoriferous, and others likewise flowering; the arbutus mingling with the herbarea, the feto, the musgo, and the agarico, in the midst of which rose the silva, the era, the corriola, the alegra-campo, and other evergreens and creeping plants, which wove their festoons from branch to branch; and gave new shade to a lovely land, all clothed with vegetation; and new force to innumerable springs of pure and salubrious water.

There was no quadruped whatever on the Island, and scarcely an amphibious animal. But, over these silent solitudes, soared various birds of prey, and ten different sorts of singing birds warbled their sweetest notes. Various species of aquatic fowls had their nests in the huge volcanic rocks which line the shore; and nature displayed her affluence in the variety of the insect tribes."

The Island of Porto Santo, which is distant about fifty miles from Madeira, was discovered by

Bartholomew Perestrello, a Portuguese, in 1418. Both these Islands were peopled, and the sugar cane and vine introduced, in 1425.

Madeira is situated in 32° 37′ north latitude, and in 17° longitude west of Greenwich. It is distant 240 miles north-east of Teneriffe, 360 miles from Cape Cantin on the coast of Africa, 50 miles south-west from Porto Santo, and nearly 300 miles from the Isle of Ferro.

Its form is an irregular quadrangle, very oblong and stretching from east to west; and, according to the survey of Colonel Paulo d'Almeida, whose observations are considered very correct, the greatest length of the Island is $38\frac{1}{4}$ English miles, its greatest breadth 12 geographical miles, and its circumference 96 geographical miles. Almost every Portuguese historian, except Barros, commences his account of the discovery of Madeira, with the romantic history of two English lovers, who are said to have been driven on the Island in 1344.

Machim's story is thus related by Alcaforado:—"In the reign of Edward III., Robert Machim, an accomplished gentleman, of the second degree of nobility, loved—and was beloved by—the beautiful Anna d'Arfet, the daughter of a noble of the first class. By virtue of a royal warrant, Machim was incarcerated for his presumption; and, on his release, endured the bitter mortification of learning that Anna had been forcibly married to a noble, who had carried her to his castle, near Bristol. A friend of Machim's had the address to introduce

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himself into the family, and became the groom of the broken-hearted Anna; who was thus persuaded, and enabled, to escape on board a vessel with her lover, with the view of ending her days with him in France. In their hurry and alarm they embarked without the pilot; and the season of the year being the most unfavourable, were soon at the mercy of a dreadful storm. The desired port was missed during the night, and the vessel driven out to sea. After twelve days of suffering, they discovered faint traces of land in the horizon, and succeeded in making the spot still called Machico. The exhausted Anna was conveyed on shore; and Machim had spent three days in exploring the neighbourhood with his friends, when the vessel, which they had left in charge of the mariners, broke from her moorings in a storm, and was wrecked on the coast of Morocco, where the crew were made slaves. Anna became dumb with sorrow, and expired three days after. Machim survived her but five days, enjoining his companions to bury him in the same grave, under the venerable cedar, where they had, a few days before, erected a cross in acknowledgment of their happy deliverance. An inscription, composed by Machim, was carved on the cross, with the request that the next Christian who might chance to visit the spot would erect a church there. Having performed this last sad duty, the survivors fitted out the boat, which they had drawn ashore on their landing; and, putting to sea, in the hope of reaching some part of Europe, were also

driven on the coast of Morocco, and rejoined their companions—but in slavery. Zargo, during an expedition of discovery to the coast of Africa, took a Spanish vessel with redeemed captives; amongst whom was an experienced pilot, named Morales; who entered into the service of Zargo, and gave him an account of the adventures of Machim, as communicated to him by the English captives, and of the land-marks and situation of the newly-discovered Island. Galvano relates the same story from the Castilian Chronicles, with the difference, that Machim survived, and reached Castile, after being made a prisoner by the Moors."

Bowdich gives some credit to the truth of the story, from the town being called Machico; but all recent writers on Madeira think it a mere romance, from the fact that the information given by Machim's companions, was not made use of until seventy-five years afterwards. Zargo and Vaz are said to have discovered the remains of the two lovers in a cave, side by side; and to have erected a tomb with an inscription; and also, a chapel over them, dedicated to Christ, in compliance with the request of Machim. The church which Vaz built in honour of Christ at Machico, although in a great measure re-modelled, remains to this day; and Machim's chapel is shown, in which is a small piece of wood, said to be the remains of Machim's cross.

From the fact that the larger Island is generally to be seen from the smaller one, it is somewhat singular that Porto Santo was discovered in 1418,

and that Madeira was not known until the following year. It is therefore to be wondered at that Perestrello did not prosecute his voyage after he had discovered Porto Santo; being a navigator so celebrated, and one whose letters are said to have stimulated Columbus to undertake the expedition that led to the discovery of America. There seems to exist considerable doubt whether Vaz really accompanied Zargo or not, on his first falling in with the Island. Manoel Thomas, the author of the *Insulana*, a work written nearly two centuries and a half ago, declares "most positively" that the former did not go there until the second expedition. Cordeyro states that Rui Paes was the first person who landed, having been sent on shore in a boat by Zargo; and the same author, as well as Barros and Manoel Thomas, doubts that Perestrello was the original discoverers of Porto Santo; and conjectures that it was known a year before, by some Spaniards and Frenchmen on their way to the Canaries. It is, however, admitted by all, that Porto Santo was discovered before Madeira; and that Zargo, if not also Vaz, was the discoverer of Madeira, and that he first landed at Machico—no credit whatever being attachable to the story of Machim.

The fifteenth century was, doubtless, the most brilliant period in Portuguese history; and "Henry, the navigator," as he has been styled, was the "star" of the day. With him, we may say, originated all the discoveries of that century; and all writers agree that he was the greatest scholar of his day,

and the great patron of the arts. Don Henry, indeed, may be looked upon as the discoverer of Madeira; for, but for him, Zargo would never have been sent on his expedition. He was third son of Don John I., master of the order of Christ, Duke of Vizeu, and Lord of Sagres in Algarve. There were great rejoicings at Lisbon on the return of the expedition. The King, Don John I., dedicated, or gave, the new discovery to the order of Christ, of which Don Henry was grand-master; and in 1842, the gift of the spiritualities of the Island was confirmed by Pope Eugenio IV. The captaincies of Funchal and Machico were conferred upon Zargo and Vaz, and their heirs, and the king gave Zargo the family name of Camara. On their return to the Island, Zargo proceeded to Funchal, so called from the quantity of fennel—*funcho*—that grew on that part of the Island; and built a church there which he dedicated to St. Catherine, whom his wife held in a peculiar devotional honour. The second church that was erected was N. S. do Calhão; and the third, N. S. Conçeiçao—The Conception—da Cima.

Previous to his exploratory expedition, Zargo had distinguished himself in the annals of Portugal; particularly at the conquest of Ceuta, in 1415. His name was held in great esteem in Lisbon; and, in order to do him honour, the King, Don Alphonso the Fifth, sent four noblemen to espouse his daughters; from which marriages descended some of the most illustrious families in the Island. He was forty-seven years Governor of the district of Fun-

chal; and, in his old age, used to be carried out into the sun to hear complaints, and administer justice. The descendant of Zargo, João Gonzalves da Camara, second Captain of Funchal, built a large Franciscan convent; but, during his time, little is recorded of Madeira. His successor, Simão Gonzalves da Camara, obtained the surname of "Magnificent," from the splendid style of his living; and from being so regal, in the number of his retainers. In the reign of Don Emanuel, Simão crossed to Africa with thirteen ships, armed with cannon, and bearing twelve hundred Madeirese soldiers, whom he kept at his own expense. He there joined the royal army, passing nine times from the Island to Barbary; in all which expeditions he was successful against the Moors. The fourth Captain was João Gonzalves da Camara, who was little less magnificent than his father. He took eight hundred foot soldiers, all well born, and two hundred horse, to Lisbon, offering their services to the King, whereupon he proceeded to Barbary, and gained many victories; particularly in the siege of Azamor. In October, 1566, in the Captaincy of Simão Gonzalves da Camara, the fifth governor, and first Conde de Calheta, three French privateers anchored in the small bay of Praya Formoza, to the west of Funchal; and, landing about one thousand men, took and plundered the city; whereupon the Funchalese mustered seven hundred men, and a severe engagement took place; but, being so suddenly surprised, they were not capable of any great resistance; and

the French got possession of the city, where they remained fifteen days. There was no cause, whatever, for this outrage; as France and Portugal, at the time, were on terms of peace. They were Huguenots, who had come from Rochelle; and, during the conflict, they slew more than three hundred of the Funchalese; and escaped with their disgraceful booty, consisting of treasures, jewels, and other precious effects of the citizens, just before the arrival of a fleet from Lisbon, which had been sent for by Simão, immediately on the arrival of the French. Menezes, an ancient writer, says that the armada of relief was fitted out at Lisbon, in less than eight days, with a rapidity never before seen; that the total amount of property of which the Islanders were robbed reached to a million and a-half of gold pieces; and that, while the French had occupation of the town, the inhabitants betook themselves to the Serra, where they hid during the fifteen days that Funchal was in possession of the enemy. An additional outrage, which he declares them to have perpetrated, was that of carrying off all the small pieces of cannon which they could find, and spitefully breaking in pieces those of a calibre so great as not to admit of their being conveniently removed.

In default of heirs, the Captaincy of Machico reverted to the Crown, in 1540; but was afterwards given by the King to Antonio da Silva de Menezes.

St. James the Less, is the patron saint of the

Island; the Camera, annually walking from the Cathedral to the Sicorro Church, to return him thanks, in fulfilment of a promise made to him when the Island was ravaged by an epidemic, which his good offices availed to stay.

In 1508, Funchal was made a city, with its Camera, equal in privileges to that of Lisbon; in 1514, it was made a Bishoprick; and, in 1539, an Archbishoprick; which latter dignity, however, it only retained until the creation of the Archbishoprick of Goa, in 1547.

The name of Christopher Columbus is connected with the early history of Madeira; in consequence of his having married the daughter of Perestrello, the discoverer, and afterwards governor of Porto Santo. His wife's mother put him in possession of the letters and journals of her late husband; and there is little doubt, that, profiting by these, as well as by the leisure of a residence at Porto Santo, where his wife had some property, the mind of Columbus was first roused to the projecting of fresh discoveries. It is also said that he occasionally resided in Madeira.

During the fifteenth century a very large trade had arisen with the Island; the manufactures of various countries being imported, and produce taken in exchange; whence both Funchal and Machico greatly increased in size and population, and several other towns were founded, both on the north and south side of the Island.

Barros, the Portuguese historian, in 1552, writ-

ing on the discovery of Madeira, says:—"Thus was discovered an Island of which the name is already celebrated throughout all the nations of Europe, and through many parts of Africa and the East,—an Island so great and wealthy, its soil so fertile, and its inhabitants so noble; that, setting aside England, of old renowned for the power of its people, and the fame of its kings, it may well boast itself the princess of all the isles of the ocean."

In the year 1582, the Island passed into the possession of Spain, under Philip II.; when the commerce of the place gradually declined; until Don João IV., of Portugal, threw off the Spanish yoke. After the solid peace of 1688, its trade began to revive. Whilst under Philip, the two Captaincies, into which the Island was divided, were superseded by a single governor; which form of government remains to the present day.

The sugar-cane seems to have been greatly cultivated in the Island soon after its discovery; having been introduced from Sicily by Prince Henry. The first mill was built in 1452. The first sugar was made in the Machico district; but, before the end of the fifteenth century, there were upwards of 120 mills in different parts of the Island. The quinto of sugar—the proportion which went to the crown—amounted to 30,000 arrobas, or 1,000,000 lbs. English. Portugal, Spain, and Italy, were the principal importers of this sugar, in moist and refined qualities. De Freitas's MS. says,—"During the Spanish usurpation, that nation, struggling with Holland,

and at enmity with England; weighing on Italy, whose states she disturbed; and fomenting internal discords in France; kept away the merchant ships of those several countries from the ports of Portugal. The policy of the Philips, and their unjust and violent government, fell, with a fearfully oppressive weight, upon the Island; and we saw our greatest article of export, sugar, dwindle almost to nothing, from the year 1600, through the abundance which began to be produced at different points in America."

The sugar cane was first conveyed from Madeira to the Brazils and West Indies; but, now, not a cane is crushed or made into sugar on the Island; the supplies of moist sugars being received from the Brazils *via* Lisbon; and the refined sorts, from England.

During the seventeenth century, the trade of the Island had greatly increased; and the vine was cultivated to a considerable extent; numbers of English houses were largely engaged in exporting wines, not only to England, but to America, and the West Indies, also; whence the wealth of the Island was vastly increased.

The English government sent troops to the Island in 1801, which left during the following year. In 1807, it was surrendered to General Beresford; but in 1808 was restored, though continuing to be garrisoned by English troops till 1814.

When the constitution of 1820 was proclaimed, all was joy and gladness; feasts, illuminations, &c., taking place in the city for some time after. But

in 1823, when news arrived that the constitution in Lisbon, was overthrown, and that Don João the Sixth had again proclaimed himself absolute King; a deep gloom appeared to hang over the citizens of Funchal, accompanied with an unusual quiet state of things, that boded no good; the change giving great dissatisfaction to all, except the very lowest class.

Information was sent to the government at Lisbon, that a conspiracy was forming to give the Island into the hands of the English; and in consequence, a new Governor—D. Manoel de Portugal—was sent out with an *Alçada*, or extraordinary commission, to inquire into the state of matters. Many persons were arrested, and afterwards imprisoned, or banished to Africa. Madeira then remained under absolute government until 1827; when, on the death of Don João the Sixth, the sovereignty legally devolved upon Don Pedro; although, at the time, considered as a foreign Prince.

When, by the law of Portugal, it was enacted that no foreign Prince should wear the crown; it was not supposed that her colonies would declare themselves independent; and it could not, therefore, be intended that, because the heir presumptive happened to be Sovereign of one of her newly emancipated colonies, he should, on that account, be deprived of his right of succession. Don Miguel, therefore, acknowledged his brother as lawful King, and accepted his offer of being Lieutenant, or *Tenenti Rei;* but, leaving Vienna, and arriving in

Lisbon by way of England, he shortly afterwards caused himself to be proclaimed King of Portugal.

In 1828, a frigate arrived with Jose Maria Monteiro, who had been appointed Governor by Miguel; but being refused admittance by Valdez,—afterwards Baron Bomfim—who was then Governor—he was compelled to sail again for Lisbon. The Miguelite authority, however, returning with a fleet shortly afterwards, and landing at Machico, took possession of the Island; whereupon the ex-Governor, and other officers, with many of the principal Portuguese, took refuge on board the *Ariadne*, Captain Canning, by whom they were taken to the neighbourhood of Porto Santo, and there put on board an English brig, which landed them at Plymouth.

In June, 1834, a frigate appeared off the Island, bringing, as it was rightly conjectured, some public intelligence of great moment. Nothing, however, was learnt, as to its subject; till, by the means of Marryat's signals, the English merchants telegraphing with Capt. Bertram, who was in command of the frigate, made themselves acquainted with the fact, that an important change had taken place. The news of Don Miguel's having been taken, soon spread amongst the inhabitants, who, along with the soldiers, appeared anxious for some public manifestation. The Governor, was waited upon, but refused to acknowledge Donna Maria as Queen of Portugal; and gave orders to the officers in command of the forts, &c., to fire upon the vessel if she entered the bay. During this suspense, a major of

the Caçadores, in the public *praça*, took off his cap, and gave "*vivas*" to Donna Maria II. and the constitution. A large concourse of people was collected. In less than two hours, some thousands of flags, favourable to the change—many of them beautifully worked upon silk—were seen waving from the balconies of the houses in the city; although a most diligent search for the discovery of such emblems had been previously made by the authorities. The Governor immediately embarked for Lisbon, Capt. Bertram being appointed in his place, and continuing in office till the arrival of Mouzinho D'Albuquerque.

At two o'clock a.m., on April 30, 1847, the inhabitants of Funchal were roused from their slumbers by the galloping through the streets of four pieces of artillery, accompanied by the troops of the 4th and 11th regiments;—proclaiming by loud *vivas* the constitution of '20, and the Sovereign Junta of Oporto. The 4th artillery then proceeded, first, to the barracks of the 11th; when, immediately joining companies, the whole marched to the Governor's palace, pointing one of the pieces, with match lighted, directly in front of the entrance.

The Governor, having listened to what they had to communicate, requested half an hour for consideration; which being granted, he immediately summoned the Camara, and, after some discussion, determined upon resigning office. At 9 o'clock he walked out in front of the palace, accompanied by the Camara, when the Secretary read aloud to

the troops the decision of the Governor, and the "pronunciamento in favour of the Junta!" The Governor afterwards addressed the troops, in a very patriotic speech; assuring them of his firm adhesion to the Queen, and offering his advice and counsel, if requested, in the present new state of affairs. The following day, the Governor left the palace; and Funchal, under the new government, was kept in a very excited state until the 26th July; on which day the Junta surrendered all authority into the hands of the commanders of the English and French squadron, then at anchor in the bay.

An English and a French officer waited on the ex-Governor, and conducted him to the palace, where the two commanders were waiting to re-instate him. The Portuguese flag was immediately hoisted at the palace, as a signal for the vessels of war, anchored in the bay, to salute. These consisted of the frigate, Thetis; steamer, Terrible; and brig Recruit,—English; of the French frigate, Armidi, and of the Portuguese corvette, Don João Primeiro, and brig Douro. Each vessel, with the Loo and Peak forts, fired a salute of twenty-one guns; the Governor was received, everywhere, with the most enthusiastic cheering; flags were to be seen flying from nearly every balcony and turret in the city; and the illumination, at night, surpassed anything of the kind ever seen in Funchal. Great praise is due to our worthy consul, Mr. Stoddart, and to His Excellency Senhor Jose Silvestre Ribeiro,

the Governor of the Island, for their untiring zeal, and the energetic measures which restored His Excellency as Governor—without any bloodshed whatever. The Island, since then, has enjoyed the greatest tranquillity.

CHAPTER XVIII.

DESCRIPTIVE VIEW OF THE ISLAND—THE FLOODS OF 1803 AND 1842—FUNCHAL—PALHEIRO—MOUNT CHURCH—CAMA DOS LOBOS—SANTA CRUZ—MACHICO—SAN ANTONIO DA SERRA—PORTELLO—CAMACHA—ST. ANNE'S—SAN JORGE—PONTA DELGADA—SAN VICENTE—SERRA D'AGOA—JARDIM DE SERRA—CALHETA—RABACAL—PORTO SANTO.

On approaching Madeira from the north, the Island has a decidedly majestic appearance,—the summits of the mountains being generally capped with clouds; with, here and there, some jagged peak, peering above; whilst, below, are seen the dark luxuriant foliage of the forest trees; and, again, lower still, a bold range of cliffs, lashed at the base by the broad swell of the Atlantic, and presenting, occasionally, an opening ravine like the mouth of some vast chasm. Nearly the whole of the coast consists of a succession of cliffs, or headlands; the most remarkable of which, Cape Girão, is more than one thousand seven hundred feet above the sea, being, by far, the loftiest in the world. The cliffs, in general,

are more precipitous on the north, than on the opposite coast; from the greater prevalence of moisture, the ravines are clothed with forest trees; which is not the case on the south side of the Island. The whole Island presents the appearance, of one mass of volcanic mountains, riven into slopes, or ridges, all tending seawards, and crowned with various peaks, rising from about its centre; the highest of which, Pico Ruivo, is more than six thousand one hundred feet above the level of the sea.

Passing Point San Lorenzo—a long, low, and broken line of cliffs, forming the most eastern point of the Island; the *Desertas*—a cluster of huge rocks—lie on our left; one of which, standing, apart, on the northern extremity, appears, at a distance, like a ship in full sail. It is said that a Danish vessel of war, mistaking it for one, discharged a gun, as a signal, to hoist colours, which not being done, she fired on the rock for its disobedience. The distance between this rock and Point San Lorenzo is about nine miles.

Steering west, the villages of Machico and Santa Cruz, come into view, both prettily situated at the mouth of ravines; after which, rounding Cape Garajao—known to the English by the name of Brazen Head—we have before us the Bay of Funchal, lying like a silvery lake, if the weather be calm; with the city, nestling, as it were, in the furthermost recess.

The aspect of the Island, at some distance from land, has not a very prepossessing appearance,

seeming a barren, bare, red-brown, uncultivated steep, no trees whatever being observable, except pines,* and these on the very tops of the mountains. However, as you begin to approach the anchorage, you discern, above the city, signs of vegetation, and soon discover trellised vineyards, and embowered quintas; and rivers, traced out by lines of dark chesnut trees, planted on each bank of these *ribeiros*; and enjoy a full view of the beautiful white city, generally shining out from under a sky of brilliant blue, as though a cloud had never crossed it.

Captain Marryatt writes:—"I do not know a spot on the globe which so much astonishes and delights, upon first arrival, as the Island of Madeira. The voyager embarks, and is, in all probability, confined to his cabin, suffering under the dreadful prostration of sea sickness. Perhaps he has left England in the gloomy close of the autumn —or the frigid concentration of an English winter. In a week he again views that *terra firma* which he had quitted with regret, and which, in his sufferings, he would have given half that he possessed to regain. When he lands upon the Island, what a

* For this relief to its generally barren aspect, the Island is indebted to Senhor Luiz d'Ornellas Vasconcellos, a gentleman of the most courteous deportment, enhanced by a cordiality which can spring alone from a nature that is truly and generously social. He is the brother of the only peer of Madeira—Baron San Pedro; and by his spirited enterprise, a mountain, whose summit formerly presented a region of the bleakest sterility, is now thickly and widely planted with pine; an example patriotically set, and calculated to excite emulation, as it has already done; and the results of which may be reasonably anticipated in the general substitution of verdure and beauty, for sternness and unproductiveness. The plantation of Senhor d'Ornellas covers an extent of 250 acres.

change! Winter has become summer; the naked trees, which he left, are exchanged for the most luxuriant and varied foliage; snow and frost, for warmth and splendour; the scenery of the temperate zone, for the profusion and magnificence of the tropics; a bright blue sky; a glowing sun; hills covered with vines; a deep blue sea; a picturesque and novel costume—all meet and delight the eye, just at the precise moment, when to have been landed, even upon a barren island, would have been considered a luxury."

To the left of the bay, at a short distance from the shore, is the *Ilheo*, or, as it is called, "Loo Rock," surmounted by a fort, and provided with a telegraph, in connexion with others on the heights, both to the east and west of Funchal; and, also, with one which is erected on the Governor's palace, seen close to the beach, and nearly adjoining the custom-house. Opposite the Loo stands the Pontinha fort, built on a ridge of rock running out into the sea; whilst, to the right, and at the other extremity of the city, appears the fort St. Jago, near which, and close to the sea, lies a public walk, called Praça Academica; while another promenade is observed in front of the Governor's house, named Praça da Rainha. The most prominent objects—viewing the city from the bay—are the Peak Castle, the Loo Rock, the pillar on the beach—said to have been built for the unloading of boats, but never finished—and the Mount Church, at an elevation of nineteen hundred feet.

All the large houses have turrets of a considerable height, for the convenience of viewing the sea; and looking out for the arrival of vessels, or watching their departure. These, with the towers and spires of the various churches and convents in the city, are all that appear distinct from a mass or cluster of white houses, seemingly built without order or regularity. To a stranger, the peculiar charm in the appearance of Funchal, is the clean and white appearance of the buildings, almost free from smoke, and strikingly contrasting with the dark back-ground of the steeps above, dotted over with the quintas, or villas, of the merchants, and terminating in an amphitheatre of mountains; that rise to the height of four thousand feet, and give to the whole, that picturesque appearance which a visitor rarely or never forgets.

On the face of the mountains, may be seen deep-cleft ravines; those, above Funchal; concentrating their streams into three *ribeiros* or rivers, which pass through the city into the sea; their channels being from 80 to 100 feet in width, and from 20 to 30 feet in depth, with strong stone walls on each side. During the summer months, these rivers are never entirely dry, whilst, in the rainy season, the torrents descend with great force.

In October, 1803, there occurred, at the eastern end of the city, a very disastrous flood. There had not been a shower for several months, and the rivers were almost dry. On this occasion the rain began about mid-day; continued, incessantly;

and, at eight o'clock, the river, N. S. do Calhao, augmented from a rill into a roaring flood, rushed down like a torrent sweeping away all the bridges except one, on which the surveyor had built his own house. Several houses, with the inhabitants in them, vainly imploring relief from the windows, partook of the wreck. The lower parts of these houses being full of water, it was impossible to force the doors; and, before ladders could be applied, the walls went to pieces, and the unfortunate people were lost. One house was carried into the sea, and seen there, entire, for some minutes, with the lights in the upper windows; and a similar fate befel the Church of N. S. do Calhao, situated near the river's mouth. According to the confession-lists of the priests, not more than three hundred persons were lost; but, as the principal mischief happened in a quarter of the town inhabited by sailors, among whom—it being wartime—were a great many foreigners, and prostitutes, who were never on the confession-lists; the total loss of lives must have amounted to upwards of four hundred. The streets were choked with ruins, and with heaps of dead oxen, sheep, and domestic animals; and the church doors were blocked up with bodies, laid there to be owned, and accumulating as the streets were cleared. Some of these apparently retaining the spark of life, were neglected and allowed to expire, in the general panic and confusion. The whole were afterwards, burned; and all the pitch and tar, at hand, were put in

requisition to fumigate the streets, by bonfires. It is said to have been scarcely less distressing to see the despondence which, for days, pervaded almost the whole of the lower classes. They believed that the end of the world was fast approaching, and would make no exertion; but remained like statues, until roused by a renewal of the rain, when they, simultaneously, ran from their houses; some rushing through the crowd with torches, others rolling over each other in the darkness of the night, and many returning in despair, unable to find a retreat. The peasantry flocked to Funchal, thinking that the calamity had been confined to the country; and, on their way, encountered the towns-people flying for safety to the higher ground. One good, however, resulted amidst all this havoc; for the quantity of earth carried into the sea diminished the soundings and anchorage of the harbour, several fathoms. The duration of the rain; incessant and heavy as it was, could not account for effects so extensive and disastrous. The general conclusion was that a water-spout must have burst; an occurrence, rendered the more probable from the fact, that the interior of the Island presented an appearance as if large tracts of ground had been broken up, and thoroughly swept away.

Another calamity of the same kind, of which I was an eye-witness, happened in October, 1842, by the sudden overflowing of the same river; and was attended with, probably, as great a destruction to property, as the flood in 1803; but which, happen-

ing in the day-time, was unaccompanied with loss of life. The summer of 1842 had been excessively hot, with hardly any rain; but on the 15th October, the clouds gathered on the mountains; and, on the following day, loud thunder was heard; and the rain fell in floods, and continued, almost without intermission, until the morning of the 24th, when it partly ceased. About mid-day the whole of the Island appeared covered with one vast cloud, threatening total darkness; the barometer fell considerably; the air became very oppressive, with a strong smell of sulphur; and the wind veered about to nearly every point of the compass. At one o'clock, the rain recommenced, as violent as before; and, at about two o'clock, I perceived, at a distance of between one and two miles from the shore, an immense rising or heaving of the sea, which soon became connected with a dense mass of dark clouds overhanging the bay, apparently threatening a deluge, and remaining in this state for the space of about ten minutes; when, at length, ascending, it was carried by the wind in the direction of the mountains; and from what resulted must, assuredly, have burst there. Although the rain continued without any abatement, I left my house, at three o'clock, for the river side; before reaching which, the roar of the water began to give me some alarm; and, arriving at the Roxinha, the appalling sight that presented itself in every direction was enough to carry terror to the stoutest heart and arouse the most appalling apprehensions.

The street was upwards of three feet deep with water, and hundreds of men, women, and children, were wading their way up the stream, struggling to reach the mountains; whilst others were flocking towards the town; none knowing whither to fly for safety; and this, amidst the most dreadful shrieks and cries that can, possibly, be imagined. I arrived, as the water was beginning to overflow the banks of the river, and, immediately afterwards, saw the Roxinha bridge knocked to pieces, and swept away by the torrent, as though it had been only built of pasteboard. It is impossible to convey any adequate idea of the awful grandeur of the scene. The noise of the rocks rushing down the torrent was more like continued thunder than anything I can describe,—the water roaring and boiling in its furious descent,—the violent shaking of the ground in every direction,—the screams and prayers of the poor Portuguese,—the terror which every countenance betrayed—the dreadful idea that night would soon be setting in—all conspired to arouse feelings such as neither pen nor tongue can adequately pourtray. Never can those two hours of horror be eradicated from my memory! The river having overflowed, the inmates of the houses in the neighbouring streets had to escape through the windows, or over the roofs. Wine lodges were burst open by the torrents, and their contents swept into the sea. Upwards of two hundred houses were destroyed or made untenantable by this disastrous flood, and the loss of property, in wine, corn, &c.,

was immense. At the mouth of the river N.S. do Calhão, a fruit market, and part of a fort, with the entrance to the Praça Academica, were entirely carried away; and the bed of the river, formerly more than thirty feet in depth, was filled up with immense rocks and stones torn down from the mountains. The great body of water began to abate about five o'clock, but the rain continued during the night; the weather moderating, however, on the 25th, with a strong breeze from the south-east. The Governor having called a meeting of the authorities, food was distributed to the poor in the neighbourhood of the river, whilst several forts and other buildings were opened for their accommodation, until they should provide themselves with other shelter. Every arrangement was made in order to prevent drunkenness in the streets, and robberies at night; but, as casks of wine were rolling about in every direction, and whole streets of houses were open to any one who wished to enter,—the inmates having fled,—many robberies, and numerous revolting scenes of intoxication, occurred.

At three o'clock p.m., on the 26th, the wind suddenly veered to the south, blowing a perfect hurricane, the sea rushing over the beach, and entering into the lower parts of the city. Six vessels were at anchor in the bay, apparently without any possibility of escape, by making sail; as the wind was dead in, the waves rolling furiously towards the beach. The first vessel came on shore

about five o'clock; an American brig, the crew of which was saved, followed; and was succeeded, soon after, by an English schooner, the crew of which also escaped. It was now dark; but numbers of persons, including the writer, continued on the beach, with the view of rendering assistance. A Portuguese schooner was the next victim; and although, aided by the few lights we had on the beach, every exertion was made to save the whole of the crew; four of them were unfortunately drowned. The favourite brig, Dart, of London, was the next that drove. The crew of this vessel was saved. A different fate awaited the crew of a Sardinian schooner, which dragged her anchors about the same time; for she struck on the face of the rocks, near the Sicorro Church, and all on board were lost. The barque Success, was now the only craft that was left, and she owed her safety to the great depth of water in the immediate vicinity of the Loo Rock, in the direction of which she drove, and the back surge from which most certainly kept her from striking on this dangerous spot. The wind providentially veered to the south-west at nine o'clock p.m., and at daylight, the following morning, she left the roadstead in safety.

Funchal is not a handsome city, but it is clean in comparison with Lisbon, Oporto, or any other town in the mother country—a great desideratum in such a climate as this; and although, on first landing, the visitor may be disappointed with its appearance; yet the novelty of the costume of the peasants, the

sounds of the language, the mode of conveyance, &c., differ so much from what we are accustomed to at home, that its drawbacks,—and it has many, —are overlooked for a time. The population of the city consists of about 25,000 persons, numbering, amongst them, about 100 English families, resident on the Island. Its streets are narrow, and in most parts steep, paved with small pebbles, and without parapets. There are no buildings, whatever, worth describing; although the residence of the Governor, and of the English Consul, are both on a scale of great magnitude; while the houses of the merchants in general are handsome.

The cathedral is a fine building, but, like the other churches in the city, it has nothing particularly interesting in the interior; the few paintings and statues, there, being of little value. The English church, of which the Rev. T. K. Brown is the present chaplain, and which was built by subscription, at the cost of upwards of £10,000, is a small but neat edifice, beautifully situated near to the Rua da Carreira, the principal street, and surrounded by trees and adorned with flowers of every variety. The burial-ground, in a more secluded spot, stands at a short distance from the chapel.

The houses are all whitewashed, giving the exterior a neat and clean appearance, the lower or ground stories being generally used as offices, or stores; and the families living on the first floor.

All the large houses have balconies; which, considering the indolence that such a climate naturally

promotes, are places of great resort, presenting a not unpleasant way of killing time. There is an excellent fish market, as well as two markets for fruit; and every Saturday a fair is held for the sale of cattle, and all kinds of country or mountain produce.

In order to make the description of the various places worth visiting, as useful as possible, I have abridged from my journal the different excursions in which I engaged, beginning with those in the more immediate neighbourhood of the city.

Palheiro.—The grounds of the late Count Carvalhal are by far the finest on the Island, possessing a level surface, so very difficult to be met with, here, to any extent. This quinta was recommended to us for our first ride into the country; and, after some delay in making choice of ponies, and of such *burroqueros* as we intended thereafter to patronise, we took an eastward course from the city. Crossing a bridge over the river N.S. do Calhão, we saw the destructive effects of the floods of 1803 and 1842. The road from this bridge to the foot of the Caminho da Palheiro, is one of the best in the Island; in fact, the whole of it is good, although not so well paved, after you have passed the quinta d'Esperança. After having been on the ascent for the greater part of upwards of three miles, we reached the gates, or entrance, of the Palheiro, which is seated at an elevation of more than two thousand feet above the sea. The park, if we may so term it, is more in the English style than we

expected to find it; but when we came to the orange, lemon, pomegranate, and shaddock groves, which were in fine foliage, and planted in the best order, we, at once, appreciated the effects of this southern clime. The flower gardens, though not abounding in that variety one might expect, are well arranged; but begin to show more of the "fallen state" of things than the other parts of the grounds. The house, itself, is not on a large scale; yet, as well as the chapel, a neat edifice, at a short distance, is built in good style, and is in keeping with the place. The Count Carvalhal used to employ more than two hundred men on the estate, for the purpose of keeping it in order. He was a kind landlord, and was much respected throughout the whole of the Island. The flowers that most attracted us were the camellias, which bloomed, in the greatest profusion, in white, crimson, crimson and white, and other colours, on trees upwards of twenty feet in height. They flourish here much better than in situations nearer the city; where, of course, it is warmer. Various species of the cactus tribe, and of considerable growth, displayed their beautiful and singular flowers.

To view these grounds, an order is necessary from G. D. Welsh, Esq., who has the management of the estate; and whose prompt urbanity allows no impediment to be thrown in the way of those who may wish to visit it.

Nossa Senhora do Monte.—We rode to the Mount Church, which, as you first enter the bay, appears

so conspicuous on the heights above. The road is well paved, though very steep; so much so, indeed, that it really appears dangerous to venture, up or down on horseback; yet the wonderful agility of the ponies, here, and the rare occurrence of any accident, divest you of any uneasy apprehension in attempting a pass or mountain of any kind. It is astonishing, too, with what speed you ascend; while the *burroquero*, always keeping up with you, occasionally catches hold of the animal's tail, and, thus assisted, will run for two or three miles together.

The road lies between the high walls of different quintas, which, in this direction, are very numerous; and, though the former intercept your view of the country around, they are far from annoying you; the sides being often covered with flowering shrubs, whilst, above them, are seen the fuschia, geranium, myrtle, &c., in all their beauty, hanging over the terraces, or clinging to the pillars which support the trellises of the vines. Each quinta has its summer-house overlooking the road, and tastefully decorated.

The interior of the church exhibits nothing particularly interesting, if we except "Our Lady," who is bedizened with glittering jewels from head to foot; far more so than anything of the kind that I had previously seen. She is a great favourite, here, amongst all classes; and many notable miracles, respecting her*, are recounted. The sailors look upon Nossa Senhora do Monte as a safe protectress

in all kinds of weather. Adjacent to the church is the Mount Villa, the property of Webster Gordon, Esq., from the grounds of which, as well as in front of the church, you obtain a most magnificent view of the quintas and vineyards below,—the city, —its bay and shipping,—and of the wide Atlantic.

Cama dos Lobos.—This is a somewhat singular name, and I doubt very much if it be the original one. Why this village should be called "BED OF WOLVES," when no such animal was ever seen on the Island, I cannot imagine. It is distant about seven miles, west, from Funchal; and, in a few years, will not only increase in size and population, but become a great resort for the invalid visitors; many of whom will probably prefer its neighbourhood to that of Funchal, as a place of residence. This I anticipate from the fact, that a new carriage road, —the only one in the Island,—leading from Funchal to this village, and nearly level, has just been completed. This road passes through a most lovely and highly cultivated district, near the coast; and affords such a drive, for the invalid, as cannot be rivalled in any part of the world. This was, an accommodation, long wanted; and may be looked upon as the greatest boon, ever bestowed on the Island. His Excellency, Jose Silvestre Ribeiro, the Governor of the Island, was the originator; and our late, and ever-to-be-lamented Queen Dowager, Adelaide, when at Madeira, was a most liberal donor. This road is macadamized, is of great width, and has a parapet on each side.

The village, at present, consists mostly of fishermen's huts. It has a beautiful little bay, remarkable for the shoals of urchins with which it swarms, reminding one rather of amphibious animals, than of regular denizens of terra firma.

After noticing our stopping to lunch at this village, my journal continues,—"We resumed our way up the mountains, and after a very fatiguing ride, reached Cape Giram. This cliff, or rather headland—which is nearly perpendicular, and is said to be the highest in the world—has its summit more than 1700 feet above the sea. We had, previously, visited its base in a boat, but were somewhat disappointed, as it neither appeared so high nor so perpendicular as we had expected to find it. We, now, reached the brink of the highest part, and employed two or three peasants to roll large masses of stone over the edge, whilst we lay flat on the ground watching their descent. It was a dangerous amusement; and a fearful sight, too, as the stones bounded from ledge to ledge, often lost to our view for a moment, and then sending up clouds of dust, as they took a mighty sweep into the sea below. We now no longer doubted the height of the cliff, as stated to us on our first visit; and could scarcely believe that it was the same Cape which we had viewed from the sea, so awful did the downward view appear. A short time sufficed for this boyish sport; for, though it was sufficiently exciting, our situation was anything but pleasant.

We now retraced our steps to a high part of the

mountain, whence we enjoyed an extensive view of the valley and country around; and where, at our humble meal, we drank the health of Queen Donna Maria,—it being the anniversary of her birth-day, as well as of a particular friend of my own in England. During our stay here, a thick fog suddenly covered the whole of the valley; presenting a most singular appearance, as the thin, fleecy clouds, of which it was composed, were wafted about the lower part of the mountains; whilst, above, the atmosphere was perfectly clear, the sun shining in all its splendour. This lasted but a short time, when the wind rent the clouds asunder, and, through the opening, thus made, the sun suddenly lit up the vineyards below with magical effect, giving us one of the most brilliant and interesting sights I ever witnessed. An accident occurred, which had nearly marred our day's pleasure. A large stone, having been incautiously removed from its place, rolled down the side of the mountain, tearing its way through corn fields, vineyards, and everything before it, to the horror of the peasantry below, and the consternation of ourselves. Fortunately there was no loss of life, which might have occurred, considering the distance it went, through one of the most populous parts of the country. However, we were soon beset with a number of people from the valley, apprising us of divers sad disasters. Some had lost cattle; to the fields and vineyards of others it had done considerable injury, whilst all were equally clamorous

in demanding instant payment for some loss which, they said, they had sustained. We considered it most prudent, however, to satisfy ourselves as to the amount of damage that had really taken place; and after visiting the vineyards, &c., we found that a few dollars would amply repair the mischief; for the cattle, which they assured us had been killed, must, in the interval, have come to life again, as they were nowhere to be found.

*Santa Cruz.**—Before sunrise on a beautiful morning in April, we were on our way eastward from the city, in a narrow and stony path, somewhat hazardous to travel at that hour. Yet, after all, in rambles of this kind, there is an indescribable excitement that sets at naught difficulties, which, on any other occasion, might be considered of serious moment. The novelty of everything that appears before you; the wit and anecdote of some of the guides or attendants; the presence of agreeable companions; all these, united with the extraordinary effects of a pure atmosphere, combine to render such excursions interesting. We kept near the coast, and, at a short distance from the city, crossed a ravine,—that of the Ribeiro San Gonçalos—after which the road became steep and irregular till we reached Brazen Head; a cliff rising about 1200 feet perpendicular from the sea, and forming the most eastern projection of the Bay of

* It will be by far the best plan to make Santa Cruz, Machico, and the fossil bed near Point San Lorenzo one excursion,—and Camacha, San Antonio da Serra, and the Portella another.

Funchal. Here, the rugged eminences on either side, with a rocky beach below, over which a tremendous sea came rolling in terrific fury, gave to this point an exceedingly wild appearance. Our road still continues near the coast, with high hills to the left, on which are produced the vegetables that chiefly supply the city. Proceeding, there was nothing particularly interesting till we reached Santa Cruz, a small town, said to be eight miles distant from Funchal; but, judging from the long time we took in reaching it, these miles must certainly have been Irish ones. Our slow pace, however, arising from the number of ravines which intersect the coast, and make it a constant succession of hill and dale, may probably have deceived us, as to the length of the road.

Santa Cruz is prettily situated in a valley, with a delightful view of the mountains above. The town itself presents a mean and poor appearance; however, it boasts a church and a market place. We lunched with Mr. Grant, an English merchant, who had built a quinta here; and we saw in his grounds the finest, if not the only, date tree on the Island. Starting again, and still on the ascent for more than three miles, we suddenly came in sight of Machico, situated at the mouth of a valley, immediately below us.

The view from the height where we were now standing, was truly magnificent. The whole breadth of the valley lay before us, with its small river in the middle, the banks of which appeared well cul-

tivated, and the town of Machico close to the sea; whilst, opposite, appeared a bold range of hills, thickly popluated, and strongly contrasting in character with the black and rocky side of that which we had to descend, by a steep and circuitous route, in order to reach the valley.

Machico.—The least said of this place the better, for a more melancholy village I never beheld; although there are still to be seen some remains of former greatness. Crossing the ravine, we wound our way up the opposite mountain, not at all sorry to leave a town presenting such a scene of wretchedness, with scarcely the means of affording us shelter for the night. Having regained the heights, we now struck off into a beaten path leading to San Antonio da Serra, distant about six miles. For a short time we found the road hilly, but, afterwards came to a plain, with a firm gravel path, enriched with broom and bilberry bushes, growing high on each side, and giving out a pleasant fragrance. This table-land or "serra," as it is termed, extends for many miles, and is situated at a considerable elevation above the sea. On this height we experienced the refreshing influence of a free current of air, and our ponies must have felt its invigorating effect likewise, judging from the difficulty we experienced in restraining them from proceeding at their utmost speed; yet, more probably, they were exhilarated by that sense of freedom, which seems to inspire a horse the moment he emerges from a hilly or confined road.

San Antonio da Serra.—Arriving at the chapel, the padre, or vicar, gave us the key of a house, built here by a subscription raised amongst the English merchants of Funchal. It is solely intended for the use of visitors to the place; and, consequently, parties frequently stay here in succession, during the whole of the summer season. We requested the priest to join us at wine, after dinner, an invitation which he gladly accepted. We then went to view the interior of the chapel, which is small, and contains nothing worthy of notice; and ultimately visited two or three of the cottages in the neighbourhood, where I observed several of the women weaving a coarse linen cloth. The loom was a rude piece of workmanship, and the slow manner in which they passed the shuttle, contrasted strangely with the quickness of the process, as I have witnessed it in England.

The Portella.—This is distant about three miles from the Chapel of the Serra, and one ought not to omit seeing it, as it is one of the great lions of the Island. But let me here warn the traveller against taking *this* route to St. Anne's, &c. It is by far the most dangerous in the Island—and I have travelled nearly over the whole of it—and cannot be recommended by any one, who has ever encountered the misery and fatigue of traversing it.

The Portella, or Little Gateway, is situated on the ridge of a mountain, which divides the Island, and runs east and west. On the summit is cut an aperture, through which you suddenly come in

view of the Atlantic; the most prominent object in the scene being an immense rock, or rather mountain, standing on the coast, and called Penha d'Aguia, or Eagle Rock, presenting a singular aspect of wild and stupendous grandeur. You now look down upon an exceedingly beautiful prospect, consisting of the river and town of Fayal,—the town of Porto Cruz, immediately below;—to the west a range of high mountains,—the Torrinhas and Pico Ruivo;—whilst, to the east, is seen the outstretching savage Cape of San Lorenzo. Having left the "serra," we were soon enveloped in a thick fog, to which succeeded heavy rain; and though the road was tolerably good, yet the number of ravines we had to cross prevented us from getting on as rapidly as we wished. However, we must have proceeded at a good round pace for we lost sight of our *burroqueros;* an exceedingly rare occurrence; and after a wet and dreary ride, arrived at a beautiful village, called Camacha, by far the prettiest country spot in Madeira, and the resort, during the summer, of the principal merchants of Funchal. Mr. Hollway has lately built a large house on the mountain above the village, where visitors, staying on the Island during the summer months, will find every accommodation, and a delightful retreat from the heat of the city. Here the beautiful residence of J. Bean, Esq., and the noble mansion of William Penfold, Esq., are well worth visiting.

Resuming our journey, and passing the Palheiro, we came in sight of Funchal; the rain still falling

in torrents, as it had done nearly the whole of the way from the "serra," a distance of fourteen miles. The city, on entering, looked deserted; whilst the Carreira presented the appearance of a river. In the centre of the street, the stream came with such force, that it was difficult for the ponies to stem it; and if we shunned it on either hand, the *jet-d'eau* from each projecting mouth of the house-spouts, threatening to sweep both ourselves and our ponies into the current, forcibly reminded us of the "*medio tutissimus ibis.*" The rain, here, is not carried away by means of down-spouts, as in England, but shoots into the streets from projecting mouths just below the eaves of the buildings.

At home, we repaired as soon as possible to our *camas*, taking two or three glasses of hot sangaree. If, in a climate like this, you at any time regret the absence of an English fireside, with all its comforts, it is on an occasion like the present, when drenched with rain, and fatigued with travel, you are forced to content yourself with the feeble blaze of a few burning sticks. Your mind, then, naturally reverts to times when, under similar circumstances, you enjoyed the welcome of a bright and glowing hearth.

The *Curral.*—This is the reputed greatest lion of Madeira, and the one of which we had heard most, before we enjoyed the gratification of viewing so singular and interesting a freak of nature We left Funchal early in the morning, and proceeded, west, on the coast, as far as Cama dos Lobos, where we

turned towards the mountains; when, but for the scenery, which was constantly varying, and differed so much from what we had ever before witnessed, the ride would have been indeed fatiguing. The road lay along the edge of a deep ravine; and, as we looked down the sides of the mountains to the river, which wound its way at a depth of from 1200 to 1500 feet, the view was grand beyond description; being enriched with vegetation of every variety, from the tall and lofty chestnut tree to the whole family of heaths and brooms, flourishing in the most wild and luxuriant manner. This continued till we reached the Curral. It is almost impossible to convey, in description, anything approaching to a perfect idea of the marvellous place, which so suddenly burst upon our view, and filled us with wonder and amazement. We came, all at once, upon an immense crater, the vast sides of which consist of precipitous and craggy rocks; with, here and there, patches of verdure, or clusters of forest trees and evergreens, strongly contrasting, one with another, in position, shade, and form. The depth of the chasm, from the place where we stood, was no less than 2000 feet—half the distance of our elevation above the level of the sea; while, on our left, towered Pico Ruivo, the highest point of the whole Island. Imagine an abyss, yawning to the extent of several hundred yards; in many parts, perfectly perpendicular; and, nowhere, practicable to the bottom, without difficulty. Situated in perfect repose,

amidst the savage scenery that surrounded it, stood a village with a church, remarkable for its exceeding whiteness, and upon which—though not without a feeling of uneasiness from the depth at which it lay—we looked down from our giddy footing; admiring the picture of social quiet and security that it presented, shining, as it did, among fields of various grain and roots, diversified with the vine, the banana, and the orange tree; and smiling up, as it were, to the huge precipices that begirt it; a slip of any material portion of which would crush it, and bury it in a moment. This is a scene which may be visited, again and again; and not only without any impairment of interest, but with still increasing astonishment and gratification.

We left the *burroqueros*, in care of our ponies, at a short distance down the mountain; but they joined us, after a brief interval, bringing with them the ample lunch, which our hostess had liberally provided. This was speedily spread out before us, and was soon discussed; our appetites having been considerably whetted by our ride. Thus fortified for undertaking a descent to the bottom of the chasm, we prepared for that not very ordinary feat. The wind is generally keen, at this height, and too cold for invalids; however, the day was remarkably fine and clear; and, having what is termed a *Leste* wind, or "sirocco," coming from the African coast, it was warm and sultry. This wind, to the *natives* of Madeira, is far from healthy, and is generally followed

by severe colds, &c.; but it has no such effect on foreigners.

We had now obtained guides to conduct us; and though, upon contemplating the steepness of the track, we did not hesitate to confess some slight apprehension, that we might arrive at the bottom more speedily than we exactly wished, they assured us, that they could take us thither, in perfect safety. Each person being supported by two guides, with long sticks, to prop them in their precipitous descent, we commenced our zig-zag route, reaching the bottom in much shorter time and with far less inconveniences, than we anticipated. We had brought a letter to the worthy *Padre*, who gave us a very kind welcome, and entertained us, no doubt, as well as his larder would allow him. Wine he had none; yams, and a little fruit, with good water, and apologies—of which we received plenty—were all that he could bestow upon us; excepting, what is at all times a feast—a hearty welcome. Of course, it was incumbent upon us to visit the Lady of the Chapel; and, as good Christians, leave, each of us, our *peseta*. We now rambled about for a considerable time, admiring the beetling heights above us and around us; which, in our present position, appeared far more terrific than before; black, and craggy, and menacing; and hanging, as they seemed to be, in mid-air; whilst our path was intercepted, at times, with immense masses of rock, the *debris*, no doubt, of some huge elementary convulsion, so remote, that the memory of it had passed

away; if, indeed, its throes had not laboured, centuries before the Island became inhabited, or had not been even coeval with the progress of its manifestly volcanic formation. Nevertheless, the whole scene begat, within us, a sentiment of awe, so absorbing, as to prevent us, at the moment, from communicating our feelings to one another.

"Time flies fast," the poet sings; and so it proved with us; for ere we had ascended half-way, on our return to the top, we found that the "shades of evening" were beginning to close around us; and we were not wholly free from the apprehension, that, though we had found the descent far easier than we had anticipated, yet we were likely to be very wrong in our calculation of easily gaining the heights again. In addition to this, a heavy fog came on, and began to fill the vast basin rapidly; giving a singularly dreary aspect to all around us, sufficiently discouraging, considering the distance we had to travel ere we should arrive at Funchal. On reaching, at last, the summit, we were again discomfited; as there was no appearance of any of the *burroqueros*, whom we had ordered to wait till our return. After some delay, however, we found them; but much lower down the hill, than where we had left them with our ponies, and on the point of starting for the city without us. Though night was fast setting in, yet the exercise, which we had undergone, had prepared us for doing justice to the remainder of the good things which Mrs. F. had provided, viz., a tongue and a couple of fowls,

with two or three bottles of *vinho;* all which we counted upon meeting with at the place where we had taken our repast in the morning; so we at once sat down to partake of the said good cheer; but, alas, all had vanished! not even an empty bottle remained; the *burroqueros* having availed them selves of our absence to pay their compliments to eatables, drinkables, and everything else.

Never shall I forget our journey home. The night was dark; the road narrow and rugged on the side of the mountain, where a false step of the pony might have sent the rider, neck over heels, 1500 feet downwards into the torrent below! The guides were anxious to reach Funchal, and the wine had taken from them all idea of caution as to the turns we had to take. However, trusting to the ponies, which are rarely known to make a stumble, we kept briskly on; and reached the Carreira at ten o'clock, not over anxious to have another ride, at night, through the intricacies of a mountainous region.

The Waterfall.—One of the lions in Madeira—and one of which we had heard a great deal—is the Waterfall, about three miles from the city. At the kind invitation of Mrs. Stoddart, a friend and myself joined a party on an excursion thither. We started about nine o'clock, and found ourselves, soon, in a deep ravine; the only road to the fall lying along the bed of a river.

For a considerable time the journey was pleasant enough, as the wooded sides of the hills, which

walled us in, varied at every turn; sometimes broken and enlivened with, here and there, a patch of verdure, and a cottager's hut; at other times rugged and nearly perpendicular, with huge masses of stone hanging above us, and giving to our route, an interest, not very consistent with a feeling of perfect security. We had calculated upon arriving at the Waterfall between eleven and twelve o'clock. That hour had passed, and we were still toiling on; and though, what with skipping from rock to rock, and some laughable incident or another that ever and anon occurred, our progress was agreeable enough; still, when one and two o'clock had passed, without any appearance of the wished-for object, we thought we had been deceived with respect to the distance; and began to regret having undertaken so fatiguing an excursion. However, after being half-broiled with the sun, and nearly knocked up with sundry upsettings—all fortunately on *terra firma*—we at last arrived at the long-looked-for goal, and, certainly, felt fully compensated for our labour and endurance.

The stream of water was not large; but as it bounded over the heights above, into the basin of the amphitheatre, with an uninterrupted fall of more than 200 feet, it had a very imposing effect; and shed such a coolness, around, as was particularly grateful, after our long and harrassing walk.

A thousand thanks to Mrs. Stoddart, who had

prepared a much more social *fall;* having previously sent out wines and provisions to await us. These we found, laid out in the neatest order, in a secluded spot a short distance from the Waterfall. It was a delightful repast; and I never recollect having drunk Sercial with such a relish, as on that occasion. The ladies, with B———, and several friends accompanying them, left us, with the view of contemplating the *water;* whilst I and a few others preferred remaining with the *wine*, not forgetting that we had still the same track to retrace. After seeing, and *experiencing*, too, several other *falls*, on our way back—for the arrival of evening, accompanied with heavy damp, added to the uncertainty of our rugged footing, by rendering it extremely slippery—we reached Funchal, at ten o'clock, without, however, any very strong desire to visit the cascade again.

Excursion to the North.—This is a somewhat serious undertaking, and should never be attempted except late in the spring, or in the summer months, when the weather is perfectly settled and fine; and, even then, the invalid generally experiences great fatigue. Before sunrise, one lovely morning, in the joyous month of May, a friend and myself were making our way up the Caminho Meio, leading from the Roxinha to the mountains. We were a considerable time in reaching the summit, or ridge, named Poizo, which seems to divide the Island from north to south; soon after which, we came to a plain, or open serra, called Feyterias, with a view

of Ribeiro Frio, or cold river, which winds along at the bottom of an exceedingly-beautiful ravine, the sides of which are thickly wooded, and which lies at a depth of from 3000 to 4000 feet. By a sudden turn we come in sight of Fayal river, when, looking towards the sea, we beheld, with mingled sensations of amazement and admiration, the Penha d'Aguia—that broad, gigantic rock before alluded to, but now presenting itself with doubly enhanced effect—rising to a height of between twelve hundred and thirteen hundred feet, and standing, partly on the shore, and partly in the ocean. In another direction we gazed upon piles of barren hills, whose savage aspect contrasted strikingly with the rich umbrageous sides of Ribeiro Frio. After passing the road leading down to Fayal, our zig-zag path lay on the ridge of a mountain called Pão de Sebastião, and brought us, at last, to the valley through which the Fayal river runs. The vine is cultivated here to a very great extent, and trained on chestnut trees, giving this garden-like place a singularly beautiful appearance. Crossing a bridge, a waterfall of an immense height appeared immediately before us, while, at the same time, we found ourselves surrounded by mountain scenery of the most splendid description. We now pursued a winding course, the prospect varying at every turn, and the face of the country assuming a much wilder aspect. Our road, which hitherto had been rugged, was now tolerably good, and we were able to proceed at a much quicker pace; till arriving at a still more

commanding height, we obtained a glorious view of the valley, or amphitheatre, below, which lies exposed to the sea, with Penha d'Aguia rearing its majestic form in the centre, and backed by mountains, whose lower parts are clothed in verdure, which, as the eye ascends, gives place to jagged and naked heights, that vanish at last into the clouds. On descending the hill, at a distance of two miles from this, the church of Santa Anna appeared before us, embosomed in trees. We now entered the populous and well-cultivated valley of Santa Anna; a district which contains 14,799 inhabitants, and produces a large quantity of flax, corn, and wine. The latter article is very inferior, and mostly used for distilling into brandy. There is here a very excellent boarding-house, the only one in the Island, excepting Funchal. Two other parties meeting us here, we spent an agreeable evening, and, the following morning, resumed our journey towards Ponta Delgada. Half an hour's ride brought us in sight of the river of San Jorge, and of the parish of that name. Leaving the road, for a short distance, to our right, and ascending the hill named Boa Vista, overlooking the sea, we enjoyed a magnificent view of an immensely deep and precipitous ravine; the river of which was making its way to the sea, at a depth of more than 3000 feet from where we stood. The church of San Jorge stood on the hill to our right, and the whole of the extensive parish lay stretched out before us, covered with vines and chestnut trees, and presenting a truly rich and pic-

turesque appearance. We now descended by a circuitous, rugged, and even dangerous path, to the bottom of the valley, where the spray of the sea was dashing against the bold headland, on each side of the ravine. Then, ascending the mountain, on the opposite side, and passing the Church of San Jorge, we reached a place called Achada de Marcos, and, a little further on, descended to Ribeiro Fundo; soon after which, we had the Arco de San Jorge open before us, presenting a really wonderful appearance. It is a large amphitheatre, at the bottom of which sits a smiling little colony of white houses, shining out from between the vines which surround them, and excluded, to all appearance, from any approach except by sea. The bird's-eye view from the peak on which I stood, and which rises almost perpendicularly from the bottom of the valley to an elevation, as I am informed, of more than 2500 feet, was one of great magnificence. To my left towered huge and apparently overhanging rocks, loaded with foliage; in front stood mountain overtopped by mountain; broken into spurs, ravines, and peaks, with, here and there, towards the base, a lonely hut, enhancing, rather than relieving, the grandeur of the solitude; while on my left succeeded object to object, with forms of congenial boldness, diversity, and sublimity. Hence was pointed out to me the pass which we had to take on leaving the Arco, and which is called the Entroza. From the direction whence I viewed it, it seemed to be perfectly impracticable,

as the cliff on which it lay appeared to rise abruptly from the sea.

We, at length, descended to the bottom of the valley, where we lunched with Senhor Januario Moderno*, who gave us some wine, produced in the neighbourhood, and of most exquisite flavour. It is a light Burgundian red wine, but does not bear removal.

After passing the church, we soon arrived at the dangerous path alluded to, which, however, I found to be much safer than I expected. The road is cut out on the face of a rock, overhanging the sea; and, for a short distance, consists of narrow boards, supported by sticks driven into the crevices, below. We now reached the verge of a ravine, named Boa Ventura; at the bottom of which lies a valley, of an extraordinarily wild and romantic character, divided, throughout, by a lofty ridge, now clothed with vegetation, as it was the season when the chestnut, with which it abounds, is in leaf. Having descended to the bottom, and crossed a rapid river, that enhanced the beauty of the scene, we reached a hill, overlooking the coast. The town of Ponta Delgada lay now before us, most beautifully situated, on a low and richly cultivated point of land, jutting out from the base of the mountain. The houses, which are numerous, and sit embowered amidst vines, have a very imposing aspect. Turning westward, the road to San Vicente lay along the

* The father of Dr. Moderno, a most accomplished gentleman, as well as a physician of peculiarly eminent abilities.

beach; the mountains above us varying in height from 1000 to 3000 feet. After passing two or three waterfalls—which, from the late heavy rains, we saw to advantage—we came to a place named Passo d'Arco, practicable only at low water. My guide informed me that he had witnessed several deaths here, in consequence of persons attempting to cross, at what seemed a favourable moment. The sea recedes a considerable distance, and then returning with redoubled fury, leaves no chance of escape to the traveller who may be caught in the surf, as the cliff is quite perpendicular, and rises directly from the beach. Approaching San Vicente, the cliffs appeared to be of a much greater height, and we came to a river, the outlet of which divides into two channels, leaving a space whereon stands an insulated rock, which has been formed into a small chapel, called Hermida de San Vicente. Mass is performed here annually on St. John's Day. We entered the ravine—through which the river flows—and arrived at the village, the vicar of which having refused us admittance into his house, we found some difficulty in getting lodgings for the night. From the beach there is a view of the whole coast westward, as far as Porto Moniz. We left early the following morning, on our way to the Jardim de Serra. The valley of San Vicente abounds in orange groves, gardens, and orchards, and the vine, trained on the chestnut, as you journey along, forms a delightfully cool and pleasant avenue. From the mountain called Pico do Lombo, near 4000 feet above

the level of the sea, there is a magnificent view of the country around. As we ascended higher, we became completely enveloped in clouds, and shortly afterwards the rain came down in torrents. Passing the Encomiada, from which there is a view of the sea on both sides of the Island, we were again on the descent, and soon entered the Serra d'Agoa. Bold and rugged rocks surrounded us on every side in our circuitous descent; and, as the clouds and rain passed off, we had here and there a patch of the blue sky above, with a glimpse of the sea below, through the ravine named Ribeiro Brava. The scenery, now, as we began to ascend again, became magnificent in the extreme; and looking around us, from the Casa dos Voltas, we could hardly persuade ourselves that it was possible to find a way out of the chasm beneath, or a path to the heights above us. The mist in the valley at our feet presented the appearance of one immense lake. Still, on the ascent, at every turn of our path, some new object attracted our attention, either from the ravine at our feet, or the craggy peaks that looked down upon us. We at length arrived at Rocha Alta, where we lunched. The pass along this cliff, though not so dangerous as some that we had traversed, nevertheless, can hardly be taken without some little suspense and awe, as masses of rock not unfrequently fall from the heights that rise perpendicular to an elevation of more than 1500 feet, and send down rills of water which, crossing the path, are lost in spray, as they descend into the val-

ley. Below, where it is not quite so precipitous, the vinhatico, til, and other native trees, of immense size, spread out their foliage thickly, affording an almost impenetrable shelter to everything that grows beneath them. But it was not alone the threat of casualties, from above, that rendered our track one of peril; a false step of the pony would have precipitated the rider some 3000 feet into the ravine, on the verge of which we rode. Journeying on, we came to Boca dos Corgos, where we had, on our left, a view of the Curral; the neighbouring ravine of the Serra d'Agoa, being still visible on our right. The Curral is deservedly regarded as one of the lions of the Island; but, to those who have passed through the whole of the Serra d'Agoa, and witnessed the indescribable wildness of the scenery, it must fall far short of that pre-eminently grand and romantic ravine.

Passing along the brink of the Curral, we obtained a glimpse of Funchal, with the vessels at anchor in the bay, distant about eleven miles; and proceeding a little further we saw the sea, to the north, through the Encomiada, with Funchal still in sight on the other hand. Leaving the ridge of the Curral, we began our descent to the Jardim. Here I found that it felt exceedingly cold, and on looking at my thermometer, it had fallen to 49° Fahrenheit. Arriving at Mr. Veitch's country house, called the "Jardim de Serra," we had the pleasure of sitting down to an excellent dinner. This place well deserves to be styled the "Garden of the Mountains," and its

owner seems to spare no expense in making it a truly delightful abode. The grounds are very extensive, and the walks, for a distance of more than two miles, are bordered with the fuschia, which grows here, to a large size. The whole of the estate is covered with chestnut trees; but the vine is not cultivated, as the situation is much too cold, being upwards of 3000 feet above the level of the sea. The following morning Mr. V. showed us his tea plantations, and assured us that this plant might be cultivated here to any extent. The specimens certainly looked very healthy, and I never recollect to have tasted any beverage of the kind, which seemed, to me, to be of so delicate a flavour as the tea that was made from them. Resuming our journey on foot, we ascended a high mountain called Pico do Cruz, from which we enjoyed an exceedingly fine prospect; commanding the broad Atlantic—the Praio—Funchal—Palheiro—Mount Church—Desertas—Valley of Campanario—the mountains passed the day before, the summits of which were still enveloped in clouds—Pico Ruivo, and the beautiful garden or "Jardim" which we had just left. Half an hour's further walk, along the ridge of the mountain, through a forest of broom, brought us to the Quinta of João da Camara, pleasantly situated, and overlooking the valley of Campanario. There is here an immense large chestnut tree, in the body of which a room is cut out, containing a table, and provided with chairs for the accommodation of twelve persons. This tree was now in foliage. De-

scending hence, into the valley, by a rugged and steep path, for a distance of about two miles, we reached the country house of J. Jervis, Esq., where we met with a kind reception; our worthy host having journeyed from Funchal purposely to receive us, and to introduce to us his far-famed Sercial Madeira. We left Campanario the following day, and passing Cape Giram, and the small fishing village of Cama dos Lobos, soon after arrived at Funchal.

Excursion to the West.—This excursion, which may be undertaken either by land or by sea, is rarely attempted by invalids; the latter mode being somewhat uncertain, and the former far too laborious. In May, 1848, the writer, accompanied by his friend, Mr. Pearson, embarked in an open boat—schooner-rigged—for the "far west," as this locality, is named by the Islanders of the south; numbers of whom have never penetrated so far, owing to the exceeding difficulty of the undertaking. We left the Bay of Funchal at nine a.m., expecting to land at Calheta by one or two p.m.; but, before we had reached Ponta da Cruz, the wind came dead against us, so that we had to beat up, the rest of the way. The sail, however, was, from first to last, a most delightful one; the coast presenting fresh objects of interest at every point. Before reaching the Gorgulho, Mr. Veitch's marine villa, now used as the lazaretto; our notice was attracted by the Cano do Folle, or Nozzle of the Bellows. This is an aperture in the crest of a large rock, hollowed out by the action of the sea; and,

thus throwing up to a great height, and with a loud noise, a huge jet, or, rather column of spray, upon the entrance of every wave that approaches it. Passing this, we came successively in sight of the beautiful Bay called Praya Formosa,—the Ribeiro dos Socorridos, the outlet of the valley of the Curral,—Cama dos Lobos,—the bold headland of Cape Giram,—the town of Ribeiro Brava,—and Ponta do Sol; at which last mentioned place we arrived about 4 o'clock, and there held a consultation as to whether it would be better to return, or to proceed on our expedition. Having decided on the latter course, we stood out again to sea, and finally succeeded in reaching Calheta at half-past seven o'clock, nearly ten hours having, thus, elapsed since we left Funchal. Being expected—as I had previously written for twelve hammock-men to be in waiting for myself and my two friends—our arrival was soon made known; but, as it was now dark, with a heaving sea rolling into the bay, we were soon apprised by loud voices from the shore that it was utterly impossible to land us before daylight, next morning. After so many hours of weary buffetting with such waves, as a moderately stiff breeze produces in the Atlantic, such was hardly the repose that we looked for—to sit for a like space of time in an open boat, at anchor, and pitching as though it would go down, every moment, head foremost. This was a pleasant prospect for the night, with a continual and still increasing roll—for the wind freshened—a drizzling rain; and two of the

party invalids, and not altogether in the most cheerful of moods—a situation which might have tested the all surmounting jollity of the incomparable Dickens's *Mark Tapley.* However, we tried, at least, to make the best of it. We contrived to convert the sail into a temporary awning, and a bottle, suspended from the middle of a string, made fast to each side of the boat, into a candlestick; thus securing a certain degree of shelter, and the comfort of a light; and so, with the help of a cigar, and an occasional glass of wine, we managed to pass the hours till daylight, when, the weather having moderated, a boat came off, and landed us, though not without difficulty; as, even then, it was no easy matter to get us safely through the surf.

Our men and hammocks being in readiness, we were soon on our way to the house of Morgado Ornellas, which is beautifully situated on the side of a mountain, about three miles from Calheta. Having breakfasted here, and enjoyed a refreshing rest of a couple of hours, we resumed the rugged road to the Rabaçal, the approach to which consists of one continuous ascent of the most wretched and repelling description, excepting only the route to St. Anne's, by the Portello and Porta do Cruz. The hammock-bearers, however, by occasionally relieving each other, kept on at a good pace, and we soon attained to such an elevation that Calheta and the district we had left, appeared like a map spread out beneath us. Having enjoyed from various points of our ascent a variety of most extensive and im-

posing views; we reached, at last, the Paul de Serra, or summit of the ridge which divides the north from the south side of the Island. The sight was now one of indescribable grandeur;—the Atlantic on either side of us—Calheta—the Estreita da Calheta—and many other places more immediately below us,—whilst, to the north, appeared the forest-covered hills of the Rabaçal—the magnificent valley of the Ribeiro de Janella—and the heights above Porto Moniz—with the Paul stretching away in solemn majestic gloom to the eastward. The day was transcendantly fine and clear, not a cloud being visible in any direction, and standing at a height of more than 5000 feet above the sea, one thoroughly enjoyed the refreshing breeze; while the perfect novelty and surpassing beauty of the scenery that surrounded us, amply repaid us for the discomfort of the preceding night.

We now, almost reluctantly, began our descent to the north side of the Island, and, having arrived at the levada, which I shall describe hereafter, soon made our way to the head of the ravine.

The Rabaçal.—This is the great wonder of the "far west;" in fact, the great lion of the Island—not excepting even the Curral—and to see it was the main object of our expedition.

At the head of a deep and narrow ravine, which forms the commencement of the Ribeiro de Janella, stands a perpendicular rock, upwards of 1000 feet in height. This rock resembles, in form, the segment of a circle, with a chord of about 500 feet.

A large stream of perfectly chrystalline water descends continually from its summit, partly in one large cascade, and partly in innumerable falls, of inferior volume, varying in the rapidity of their precipitation, as they are more or less affected by friction; and issuing at every fissure through the dripping mosses and shrubs, with which the background is everywhere richly and profusely covered The water, thus collected in the bottom of the ravine, constitutes the Ribeiro de Janella, and flows, useless and unemployed, into the Atlantic.

In 1823, the then Governor of the Island brought forward the project of intercepting these waters, in their descent, by means of a channel or levada, and thus rendering them subservient to the purpose of irrigation. It was not, however, until 1836, that the work was commenced; when it went on with spirit for many years, but was, at last, suspended for want of funds; not the least benefit having accrued from the previous heavy outlay. The cliff, as I have stated, is 1000 feet high. About 300 feet from the base, a horizontal channel was cut, sloping downwards and inwards, so as to intercept and receive the water in its descent. This channel, having been completed to the extent of about 600 feet, was connected with a levada, six miles in length; when it entered a tunnel at the ridge of the mountain, with the view of conducting the water to the south side of the Island. This tunnel, if finished, would have been 300 yards in length; but I apprehend the day is not very close at

hand, when it will have reached to that extent, although about half the distance is accomplished. In size, it is more like a tunnel for a railway than a water-course. This is a strikingly painful instance of imperfect resources for realising projects of improvements. Had the success of the undertaking been equal to its merits, whole districts would have been brought into cultivation, which, now, through want of irrigation, are little better than barren wastes. I have no hesitation in stating, that land, double in extent to that which composes the amphitheatre around Funchal, and far more favourable for the cultivation of the vine, &c., has been lying useless for centuries, through the simple want of water.

The work was one of an exceedingly difficult and dangerous nature. The men employed in it were supported with ropes, suspended from the summit, 700 feet above them, with a depth of 300 feet below them. Here, sitting on small frames of wood, attached to the ends of the ropes, did they drill the holes, and blast the rocks; and when a train was laid, propelled themselves by their feet, with a spring, so as to catch hold of some projecting point, or convenient branch, by which they might remain supported, out of reach of the explosion. They frequently, too, became benumbed with the icy-cold water, which was continually dripping down upon them. During these operations, however, which lasted for years, only one fatal accident occurred.

We lunched on the banks of the levada—which is now fast filling up again by the soil from above—and looking down the magnificent valley of the Janella, enjoyed one of the finest sights on the Island.

After having examined the tunnel, and walked the six miles' length of the levada, I was forcibly struck with the idea that the *fall* inclined the wrong way. If this should ever be proved to be the case, it will not be the *only instance* of such engineering in the Island of Madeira. It had taken us three hours and a half from the Morgado's quinta in reaching the Rabaçal, a distance of about twelve miles; but, on our return, the journey occupied little more than half that time; so that we had the gratification of keeping our appointment to a six o'clock dinner. We remained all night under the hospitable roof of Morgado Diogo d'Ornellas Frazão; embarked next morning for Funchal; and, again meeting with a contrary wind, had to put into Cama dos Lobos. There we hired an oar boat, that brought us speedily into the bay, from which we had started, upon our expedition, three mornings before.

Though the Island of Porto Santo is situated at a distance of only about forty miles N.E. of Madeira, yet the opportunities of getting there are few, except by the passage-boats, which convey the produce of that Island to its neighbour. Luckily, however, the captain of an American brig, who had to wait for a cargo of wine, proposed to take his vessel, in the interval, on a trip of pleasure to Porto Santo; and having *calculated* how many passengers he could

accommodate, he engaged to carry a party of seventeen, including myself.

It was a beautiful morning, as we left the Bay of Funchal, with a breeze, just sufficient to fill the sails, and bear us gently across the blue water, from under the lee of the land. As we intended remaining on the Island four or five days, many excursions were arranged, and sundry plans devised, for our amusement; and having amply provided ourselves with stores, we all agreed that to pass a few days at sea—provided our voyage should prove to be a slow one—would hardly be unpleasant. However, after sailing close under the Desertas, and bearing away from Point Lorenzo, we were astonished, to meet with a strong north-easterly gale; and instead of the smooth water of the bay, which we had just left, we found ourselves tossing about on the billows of the wide Atlantic. The increased motion of the vessel speedily put an end to the good spirits, the jest and laugh, that had reigned on deck, for the first few hours, and gradually occasioned the disappearance of most of the passengers; whilst some, leaning over the side of the vessel, were quarrelling with themselves, at their folly in leaving land on such an excursion; and others, beginning to feel squeamish, or afraid of becoming so, were recommending our return to Funchal—a proposition, however, which was ridiculed by the few who were so fortunate as to feel no bad effects from the change. On the afternoon of the following day, we anchored in the bay of the little Island; and were soon surround-

ed by a number of boats, rowed by the most miserable-looking set of beings I ever beheld, who came to take us on shore.

There is here a firm, sandy beach, extending many miles; and, on landing, you soon reach a small town, the capital of the Island; in fact, the only town or rather village which it possesses.

Porto Santo is about fifteen miles in circumference. On the summit of the highest hill, is an old fort, about sixteen hundred feet above the level of the sea.

This Island produces about fifteen hundred pipes of wine annually, besides a quantity of corn and orchilla weed; though, from its parched and burnt appearance, at that particular time, I scarcely thought it capable, in many places, of yielding either corn or fruit. There are no trees of any kind on the Island, with the exception of four or five palm trees, at a short distance from the town;* neither, on the mountains above, do you see any such *quintas*, as, in Madeira, greet your view in every direction, giving a cheerful, social cast to the surrounding country.

The population is computed at about two thousand; and these, chiefly of the very lowest class; as persons in Madeira, convicted of theft, &c., are

* Cordeyro, an ancient writer, states that "the dragon trees of Porto Santo were so large that, fishing boats, capable of containing six or seven men, were made out of the trunks, and that the inhabitants fattened their pigs on the fruit;" but he adds that so many boats, shields, and corn-measures, had been made out of them, that, even in his time, there was scarcely a dragon tree to be seen on the Island.

banished thither; a circumstance which probably prevents many merchants from settling on the Island.

There is not a single English resident. Our letters, therefore, were addressed to the Deputy-Governor, priests, &c.; from whom we expected to obtain such accommodation as would supersede the necessity of sleeping on board the ship.

As a vessel anchoring in the Bay of Porto Santo is a rare occurrence, our arrival naturally caused no little sensation, particularly in the then unsettled state of Portugal.

Before we landed on the beach, the Governor, with a guard from the fort, and a considerable number of the villagers, had assembled to meet us, anxious to learn the cause of our visit. Our letter from the Governor of Madeira quieted their fears; and an unfurnished house was at once offered us, during our stay, an accommodation which, for want of better, we gladly accepted. Provisions, wines, cots, hammocks, &c., were then sent for from the ship; and we took possession of as miserable a dwelling as I ever recollect having seen. But the quiet of any shelter on shore, however bad, was preferred by most of the passengers to the uneasy motion of a vessel at anchor; though a cabin berth would have suited *me* much better.

Next day was a holiday, and our *casa*, in consequence, was surrounded, all day, by the peasantry, curious to catch a sight of the *Inglezes*. On visiting the Church, the *Padre*, who was in the act of preaching, came down from the pulpit, into which

having sent up a substitute, he came forward to welcome us to the Island, begging that we would supply him with a little snuff, which we did. He afterwards introduced us to two of his nieces, who were certainly above the medium style of Portuguese beauty, and who laughed and chatted away in Church, as though it were a ball-room. They had been at Madeira, and were acquainted with one of our party, a Portuguese, with whom, as well as with a friend of his, they kept up a conversation, apparently much pleased, though they lost, as one would suppose, some little edification.

There were no horses or ponies to be hired; we, therefore, took a long walk into the interior, but were ill repaid for the fatigue, as the country possesses nothing at all remarkable, unless it be the almost total absence of civilization.

The vines, which are here trained close to the ground, produce a thin, poor wine, which, when sent to Madeira, is distilled into brandy. We enjoyed some sport in shooting quails, and thus managed to pass away what otherwise would have been three tedious days; our evening's amusement consisting in recounting, each of us, the day's adventure. Thanks to our Santonian servants, who soon helped themselves and friends to the stores we had brought on shore, we re-embarked sooner than we had intended.

Weighing anchor, we started on our return to Madeira; but again having a contrary wind, we were two days at sea. However, once in the bay,

we felt a double pleasure in viewing fair Funchal* glittering before us; a transition, the effect of which was enhanced, by the recollection of the miserable Island which we had so recently quitted.

* A splendid series of Views taken by Frank Dillon, Esq., from Funchal and the neighbourhood, will be published by Colnaghi and Co., Pall Mall, London, on the 1st May, proximo.

CHAPTER XIX.

WINES OF THE ISLAND—VINTAGE—VINES—EXPORTS OF WINES—TRADE—IMPROVEMENTS—POPULATION—FRUITS, FLOWERS, ETC.—MANUFACTURES—MADEIRESE—AMUSEMENTS.

The cultivation of the vine in Madeira commenced soon after the discovery of the Island, but was not carried on to any great extent until the sugar-cane ceased to be the principal source of revenue. In the seventeenth century, wine became the main article of export, and several English houses were largely engaged in this trade, not only to England, but to America, and the East and West Indies.

There are no finer white wines in the world than those which are produced from the grape, on the south side of the Island of Madeira; if, indeed, there are any that equal them; possessing, as they do, bouquet, body, softness, and pure vinous qualities—essential characteristics of a good and generous wine. The following are the principal wines of the Island, some of which are rarely met with in England; such as the Bûal, and Tinta, &c.:

Bûal.—A delicate white wine; I think, from the same vine which yields the Bucellas, in Portugal, although it is said by many to have come from Burgundy.

Sercial.—A dry, white wine, of great body, flavour, and fine aroma; by far the finest of *all* white wines, but requiring great age to be drunk in perfection. That from Paulo do Mar is considered the best. This wine is not produced in any great quantity, as the vine plant—originally from Germany, and yielding there the Hock—only succeeds in particular spots.

Malmsey.—A rich white wine, of fine character, surpassing, in quality, Constantia, and all other sweet wines, excepting Tokay. The vine, which is called *Cadel*, originally came from Candia; and, requiring particular warmth, succeeds only in a few situations. The best wine of this name comes from the vineyards of *Fazenda dos Padres*, lying to the west of Funchal, and close to the base of Cape Giram. The *Malvazia* produces an inferior quality of this wine, requiring burnt sugar to give it a sweeter flavour. To effect the same object, the fermentation of Malmsey is checked earlier than that of other wines.

Madeira.—So called from its being produced from a variety of grapes, amongst which are the Verdelho, Bûal, Bastardo, and Negrinha, generally mixed together, and yielding a fine white wine; which, if kept a sufficient length of time, and carefully treated, is everything that can be desired in

its way. *Porto do Cruz*, although a parish in the north, is celebrated for the *Verdelho* grape, and generally produces wines almost equal to those of the south of the Island.

Tinta.—A red wine, of a Burgundy flavour, more like Masdeu than any other red wine, with which I am acquainted. When kept a couple of years, it is a good substitute for Port, and, when new, is excellent for sangaree. If kept much longer, especially in bottles, it loses both flavour and colour. The vine which yields it is called *Negro Molle,* but is not much cultivated, as the foreign demand for this wine is very limited. In order to fix the colour, the husks remain in the cask during fermentation.

Negrinha.—A rich, dark red wine, or cordial, very astringent, made from grapes dried in the sun, upon the tiles of the houses. The name of the vine is *Maroto;* but it is not much cultivated.

The time of the vintage, of course, varies with the season; though it generally takes place in the latter part of September. It commences in the spots, most favoured by the sun; and, as the picking of the grapes progresses, up the sides of the valleys, the rats, and lizards, which are very numerous, follow; not allowing a cultivator to keep his grapes on the vines, after his neighbours' are gathered, except at a considerable loss. They devour immense quantities of grapes, and are said to give the preference to the Tinta grape.

In making wine, the grapes are first trodden by

the feet, in a large wooden or stone trough; they are then placed under the press, and the juice is put the same day, in casks, to ferment. The violent part of the fermentation lasts about four or five weeks; at the end of which, the liquor is racked into other casks; but, afterwards, requires great care, as it is apt to undergo a second fermentation. It is fined with gypsum, brought from Porto Santo and Spain. The quality of the wine depends much upon its future treatment; and, in the finer and more delicate kinds, the fortifying with *good* brandy is an essential point. The best brandy that can now be had on the Island for this purpose—French being prohibited, except in bottles, and that at a high duty—is made from the wines of Porto Santo. The vines are propagated by cuttings, and planted in trenches, from four to seven feet deep—according to the nature of the soil—with a quantity of loose or stony earth placed at the bottom. There is no wine produced from the grapes for the first four or five years; after which, it seems that—taking the vineyards throughout the Island—the average yield is about one pipe per acre; though, under the most favourable circumstances, an English acre will produce four pipes of wine. In the south, the vines are trained on trellises, made of cane, about three feet in height; but, in the north, where they require firmer support, they are trained around the chestnut and other trees. If the summer be dry, the ground is afterwards watered three times from the tanks adjoining the vineyards, and which are made

at great expense. There are, at present, many situations favourable for the culture of the vine, yet almost useless through the want of water; which, however, might easily be procured by laying down pipes; certainly an expensive proceeding, but one that would soon amply repay the cultivator.

The *Colleção de Noticias* says—"The *Verdelho* vine leaf has seven lobes, the sinuses of which are not strongly marked; it is of a dark green, but perfectly bald, and the two lowest lobes are very indistinct. That of the *Negro Molle* has five distinct lobes, the two lowest closing, but not adhering, over the stalk; the sinuses are deep and round; the dentations large and rounded; it is slightly downy at the back; the nerves strong and projecting; and of a dark yellow-green, inclining a little to red at the base. The *Bastardo* leaf is rounder than most others; its lobes are indistinctly marked, and the dentations are large and sharp. It is of a light yellow-green, downy at the back, and the whole assumes a cockled appearance. Four of the sinuses of the *Buâl* leaf are very deep and sharp; the two lower are indistinct; the dentations are sharp and irregular; the leaf is hairy on both sides. There are two varieties of *Tinta;* the largest has seven lobes, decreasing in size, and the sinuses are very deep and rounded; the middle lobe is subdivided into two others, both indistinct; the smaller is of a more compact form, and the lower sinuses are much less deep than the others, and both are of a dark green with purple spots, and downy at the back. The leaf of the *Sercial* has four rounded

sinuses; the nerves are very strong, and by their projections give a cockled appearance to the leaf; it is of a very yellow-green, and cottony on both sides. It is said to grow best under precipices, in places which attract the clouds; and, as the husk is very thick, the fruit is left longer than the others to ripen. The *Cadel* leaf has four very deep and rounded sinuses, with two others less distinct; each dentation has a small yellow tip; the back of the leaf is as smooth as the upper surface, and is of a deep yellow-green. The other varieties are less marked, but all have the same smoothness and yellow tips. It was introduced from Candia before 1445, by Prince Henry."

The total quantity of wine produced, annually, on the Island, is about 30,000 pipes; of which about 6,000 only are fit for export. These are grown on the south side of the Island, and are of a fine quality. The wines of Madeira, some years ago, fell into great disrepute, and very justly so. During the war time, ending in 1814, the demand for wines, from the great number of vessels calling here, was very extensive; so much so, that the best qualities were soon disposed of; leaving in the lodges only the north wines, which are, in general, not only very poor, but also chargeable with considerable acidity. The temptation of executing orders for wines at £70 and £80 per pipe—although £20 per pipe was the value of what now remained—was too powerful to be resisted. To remove, therefore, as much as possible, the acidity and newness of fla-

vour, *estufas*, or stoves, were brought into use; that, by keeping the wines for three months in a closed place, at a high temperature—say 100 degrees—they might assume a factitious mellowness, and apparent age. This *forcing* as it may be termed, has been subsequently applied to wine of a higher class, but it deteriorates the *genuine* flavour, which no species of after-treatment can possibly restore. I am partly of opinion, however, that a more moderate, and longer-continued, heat of the *estufa*, might be of benefit, in producing an effect, similar, in some measure, to that of a voyage, round by the East or West Indies; which, after all, is the best method of bringing wine to perfection. In consequence of the foregoing practice, Madeira lost its celebrity for producing fine wines; and instead of numerous orders, as formerly, from England, the merchants received nothing but complaints of their shipments.

During this time, brandy and rum were admitted into the Island, at a trifling duty; the former being used for fortifying the wines. In 1823, a decree was passed, prohibiting wines, brandy, or other spirits from being imported, except in bottles, and, in that case, at a high duty; which act has been attended with the result of causing about 10,000 pipes of inferior wine to be distilled, annually, into brandy, for mixing with the better wines, &c.; and thus, the export trade has been improved; amounting, now, to from 6,000 to 8,000 pipes, yearly, of the best and middle qualities. There is, therefore, now, a good genuine wine sent to England, which, in time,

will be held in as high estimation as that of former years; but an extensive demand would, probably, be the means of producing the same result as before; as not more than from 6,000 to 7,000 pipes of *really fine wines* can be exported, *with the present insufficient means of irrigation.* The completion of the unfinished levada, before alluded to, would insure a supply of at least twice that number.

The total quantity of wine exported from the Island, from the 1st July, 1848, up to the 30th June, 1849, was 6,933 pipes. The trade of the Island is still in a very depressed state, and its staple product—wine—yields little or no return to the *grower*, whilst the merchants' stores are filled, without any signs of an increasing demand.

In the present condition of the peasantry, it is a matter of no surprise that thousands are annually emigrating to the West Indies and Brazil; for *any* change to them must be one of improvement. Madeira has been badly treated by the mother country, and until more liberal measures be granted her, and a reduced tariff on all goods entering the Island is established, I see no hope of a return to former prosperity. Should these changes ever take place, with a reduction of the duties on wines in England; Madeira will again flourish, and become as happy and prosperous an island as it is a beautiful and fertile one. The first great improvement, wanted at Funchal, is a good landing; and this could easily be effected, and at no very great expense, by connecting the Loo Rock with the Pontinha; thus forming

not only landing stairs and a quay, but a shelter for the vessels in the bay. The writer, during the last few years, has witnessed thirteen vessels driven on shore from their anchorage, in the roadstead; all of which became total wrecks, but might have been saved had such a break-water been constructed. A lighthouse built on the Loo Rock, would also be of great service; not only to vessels entering the harbour at night, but during strong gales, when the shipping are obliged to slip their anchors and proceed to sea.

According to the census, taken in 1847, the population of Madeira and Porto Santo amounted to a little more than 117,000 persons; showing only an increase somewhat short of 2,000 over the one taken in 1836. This, however, is easily accounted for, when we consider the numerous emigrations to the West Indies and Brazils.

POPULATION OF MADEIRA AND PORTO SANTO IN 1836.

DISTRICTS.	Families.	SEXES.			STATES.			AGES.										
		Males.	Females.	Total.	Married.	Widows & Widowers.	Single.	1 Year.	Years 1 to 5.	5 to 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 &c.
Funchal	5797	13444	15209	28653	8190	1983	18480	853	2880	3630	3448	2562	4330	3505	3111	2219	1637	470
Santa Cruz	1451	3611	3676	7287	2101	467	4719	174	799	926	922	638	1181	871	689	530	427	130
Machico	1030	2655	2552	5207	1488	362	3357	157	627	698	668	468	761	635	496	351	292	54
Santa Anna	3072	7572	7227	14799	4747	746	9306	516	1913	1768	1685	1485	2566	1633	1448	941	716	128
San Vincent	1960	4425	4423	8848	3046	482	5320	309	1143	949	1020	852	1509	986	899	650	488	43
Porto Moniz	1559	3606	3727	7333	2321	422	4590	263	721	856	847	728	1183	906	747	514	460	108
Calheta	2731	6341	6792	13133	4054	774	8305	408	1548	1754	1714	1061	1855	1489	1389	928	821	166
Ponta do Sol	3288	7851	8259	16110	5112	825	10173	558	2143	2308	2000	1294	2341	1922	1487	1037	854	166
Cama dos Lobos	2323	6119	6339	12458	3667	661	8130	409	1701	1781	1720	1075	1795	1321	1114	759	590	193
Porto Santo	374	883	785	1618	612	120	886	58	143	180	189	171	245	226	169	119	88	30
Total	23585	56507	58989	115446	35338	6842	73266	3705	13618	14850	14213	10334	17766	13494	11549	8048	6373	1488

BIRTHS IN MADEIRA, 1835.

Males, Legitimate	1807	Females, Legitimate	1868
Ditto, Illegitimate	222	Ditto, Illegitimate	205
	2029		2073

Total of Births 4102

MARRIAGES, 1065 DEATHS—Males, 1383; Females, 1368; Total, 2751.

BRITISH POPULATION in Madeira in 1836, 108 Families, 324 Persons.

From the foregoing Table, it will be seen that the population of Madeira, including the Island of Porto Santo, was 115,446, according to the census, taken in 1836. Mr. Bowdich states that, in 1823, it was 98,000 and a fraction, being an increase of fourteen per cent. above the census taken in 1836. Supposing this to be correct, we have an increase during the thirteen years of about twenty per cent.

The inhabitants of Madeira are not remarkable for longevity, but, on the contrary, in general, die very young; as will be perceived by referring to the preceding Table. The number of persons, between the ages of twenty and thirty, in 1836, was 17,766; and, between those of thirty and forty, 13,494; exhibiting a decrease in these respective ages of 4,272. This can only be accounted for by the poor diet of the lower classes, which consists of coarse bread, vegetables, and a little fish; and rarely or never of animal food. The women suffer more in health than the men, in consequence of their early marriages, and numerous offspring; as well as from the hard labour they are obliged to undergo in cutting wood on the mountains for fuel; which they bring in heavy burthens, on their heads, to Funchal. They dispose of this fire-wood in the city; and, purchasing a little dried fish, have to return home, probably a considerable distance, on the mountains. This severe labour, with meagre food, and warmth of climate, makes them old in constitution, when young in years. A source of injury to females of the higher class, is the sedentary life they lead; particularly, in summer, when they rarely venture out

of doors, except to go to church, and then, probably, in a palanquin. The district of Santa Anna, on the north-east side of the Island, appears the most unfavourable with regard to longevity, as out of a population of 14,799, there are 2,566, between the ages of twenty and thirty, and only 1,633 between those of thirty and forty, with the small number of 128 who have reached the age of seventy. Funchal does not share nearly so much in this decrease of numbers at so early an age as any of the other parishes; having a difference only of nineteen per cent., whilst the other districts exhibit a decrease of twenty-four per cent.; clearly proving that the comparatively rare occurrence of longevity arises, in a great measure, from the diet, &c.

GOVERNMENT CENSUS OF 1836.

Heads of Families, being landholders	4,550
Ditto ditto, not ditto	19,213
Persons, living solely on their income	640
Ditto, on salaries (not including the military)	401
Ditto, by industry	29,566
Ditto, partly by ditto having a small income	374
Mendicants	646

Apothecaries	12	Church Decorators.	3
Printers	5	Cabinet-makers	93
Bookbinders	2	Millers	92
Watchmakers	4	Potters	15
Miniature Painters	3	Whitesmiths	76
Goldsmiths	28	Blacksmiths	112
Painters	20	Sawyers	43
		Wood Turners	7
Carpenters	242	Coopers	188
Masons	290	Farriers	8
Tailors	73	Braziers	5
Hair Dressers	24	Coppersmiths	3
Ship Caulkers	25	Boot and Shoemakers	420
Tanners	23	Shoemakers	439
Paviors	31	Wax Chandler	1
ter	1	Upholsterers	9

Fish* is very good, and in great variety; and poultry is also plentiful. The beef is excellent, from a small breed of mountain cattle; but the mutton is very indifferent. Of game, there is the partridge, with snipes, woodcocks, and quails. The hare and pheasant, I understand, cannot be naturalized, although I know of no reason why the former should not be as plentiful, as it is in Spain and Portugal. Vegetables of all kinds are abundant; and peas, and all descriptions of salads, may be seen at table every day in the year; because, when it becomes too late for their production near Funchal, they are in perfection on the mountains. Potatoes and onions are exported to the West Indies, but not to a large extent.

Flowers, which require the greatest care in more northern latitudes, spring up spontaneously in all parts of the Island; and hedges and fences are formed of the fuschia, geranium, myrtle, wild rose, jasmine, honeysuckle, and prickly pear; giving a beautiful appearance, as you ride along, and diffusing a grateful fragrance. I do not think there is a spot in the world where so great a variety of fruits and flowers might be grown, as in Madeira; but, as no attention has been paid to their cultivation, few gardens are worth visiting, excepting those of Mrs. Penfold, at the Achada; those at the Palheiro, and those of Webster Gordon, Esq., at Mount Villa; and of the late Dr. Renton. I have, myself, paid some at-

* The Rev. Mr. Lowe, the author of a valuable work on Icthyology, states that 170 species of fish have already been discovered near the shores of Madeira.

tention to gardening at Quinta d'Esperanca, near Funchal; and, to show the luxuriance of this semi-tropical climate, I append a list of the products,* one month with another, during the year, without any aid from covering or artificial heat.

The principal manufactures are coarse linen and woollen cloths, straw hats and bonnets, baskets and shoes. Of the latter, a considerable quantity has of late years been exported to the East and West Indies. Cabinet-making, in Funchal, has entirely superseded the importation of foreign furniture. The coopers are the only workmen allowed to exercise their craft in the streets. They form a corporation, having peculiar privileges; and the casks made by them, are said to be the best in the world. The nuns are famed for making artificial flowers of feathers, and for preserving sweetmeats. But, formerly, the great charm of all, at the convent of Santa Clara, was the beautiful nun, Maria Clementini, of whom, every author on Madeira, since Coleridge,

* Fruits.—Apples, pears, peaches, apricots, nectarines, plums, cherries, strawberries, mulberries, medlars, guavas, melons, pine apples, custard apples, oranges, lemons, pomegranates, bananas, grapes, figs, prickly pear, mango, granadilla, coffee.

Flowers.—Fuschias, geraniums, verbenas, passion-flower, convolvulus, dolichos, cactus, petunias, balsams, datura, dianthus, oleanders, phloxes, zinnias, clarkias, heliotrope, camellias, magniolas, myrtles, jasmine, diosmas, psoraleas, coral trees, stocks, carnations, hibiscus, salvias, dahlias, hollyhocks, lotus jacobeus, thumbergias.

Vegetables.—Potatoes, sweet potatoes, yams, chow chow, gourds, tomatos, cayenne, cucumbers, egg plant, lettuce, spinach, cress, parsley, redishes, onions, turnips, peas, beans, cabbages, cauliflowers, in succession, except during the months of July, August, and September, when they are procurable higher up the mountains, where also are grown gooseberries, currants, bilberries, celery, &c., which do not succeed, except at a considerable elevation.

has given a history of some kind or other. Maria, I am glad to say, is no longer a nun, having left the convent, some months ago.

A considerable revenue is derived from snuff, tobacco, and soap, which articles are exclusively in the hands of government contractors; with severe penalties and transportation to those who infringe on this monopoly.

The crime of assassination in Madeira is very rare; unlike what we understand of the Portuguese character in general. Robberies are not frequent, and the prisons present a very different appearance from those in the mother country; the latter being generally crowded to suffocation.

The men are sober and inoffensive; but, from the idle and sedentary life they lead, have an aged appearance when young. They are about the middle stature, apparently strong; and are of an olive or sun-burnt complexion; with good features, dark eyes, and black curly hair. To strangers they are particularly civil and attentive, rarely meeting one in the street without taking off their *carapusa;* and are offended if the salute is not returned. The same politeness is shown to one another, even amongst the lower class of peasantry. Upon meeting, the carapusa is instantly removed, and kept so till they take leave of one another.

The ladies are much more beautiful, and also resemble the Spanish Donnas more than those of the mother country. Their figure is, in general, good, and their eyes are large and expressive. Few, even

of the higher class, speak English; but most of them are acquainted with the French language. From what I observed, they are affectionate in the extreme; and their friendships, when once formed, are warm and lasting.

There are few public amusements to be found in Funchal. With the exception of the English reading rooms, the Portuguese Club, and the Philharmonic Society, there is nothing to change the dull monotony of Madeira life. There is no theatre, no café, no resort, in fact, for young men, but the billiard table.

The members of the Portuguese Club have a ball, once a month, during the season, and very agreeable and pleasing re-unions they are. According to Portuguese etiquette, previous to the commencement of dancing, the ladies sit formally at one end of the room, apart from the gentlemen; and it is customary, at two or three o'clock in the morning, to hand, around, cups containing hot chicken broth.

By far the most delightful recreation which the Island presents, is that of the pic-nic parties—of which there is a continued succession; and, as the weather may be generally depended upon, invalids, as well as those in health, engage in these festive excursions. Horses, palanquins and hammocks are then put in requisition, and the party is frequently accompanied by a band of music. The *palanquin* is a kind of settee, curtained, cushioned, and decorated in a variety of ways, and suspended from a long pole, which is borne by two men. Every lady

on the Island has her carriage of this kind. The *hammock* is made of net-work, slung from a pole, and carried in a similar manner as the palanquin. There is not a more agreeable mode of conveyance. Lying on your back, with a cushion under your head, and a covering suspended from the pole, to keep off the direct rays of the sun, you are borne on, with an easy motion, and in perfect comfort, and with a speed that is truly astonishing, and which seems to defy impairment from the steepness or ruggedness of your road.

Appliances that might give a greater variety to Madeira life, are all that are wanted, and enterprise and ingenuity might soon provide abundance of these. Were the resources of the Island fully called into play, by the energies of public spirit; allurements in addition to those which tempt the invalid, would attract a different class of visitors, as well; Funchal would extend her bounds, and the Quinta would stud more thickly her picturesque vicinity; and an increasing and more substantial population would soon devise those means which check the inroads of *ennui*, and enhance the enjoyments of life, by judiciously and healthfully diversifying them.

CHAPTER XX.

VESSELS FROM ENGLAND TO MADEIRA—OUTFIT—CURRENCY—WEIGHTS AND MEASURES OF THE ISLAND—HOTELS, BOARDING HOUSES AND QUINTAS—LIST OF MEDICAL MEN, ETC.—ADVICE TO INVALID VISITORS.

There are frequent opportunities of getting out to Madeira from London, Liverpool, Glasgow, &c., by vessels which call at the Island, on their way to the West Indies and other parts; but Southampton is the far preferable port, not only on account of the number of such vessels as sail thence; but, also, as the station of the regular traders and West India steamers.

The only regular communication *by steam*, is the West India packet, which leaves Southampton on the 17th of each month, and generally reaches the Island on the evening of the 24th, or morning of the 25th, providing the weather has been moderate. The passage-money is £30, exclusive of beer, spirits, or wines. The traders between London and Madeira,

calling at Southampton on their outward voyage, are the Brilliant, Comet, Eclipse, and Dart, four of the finest merchant brigs in the world; fitted up with every convenience and comfort for passengers, and generally making the passage out in from seven to twelve days. The last voyages of the Brilliant and Comet—both of which left Southampton on the 21st January—only occupied *six days;* the vessels arriving in the roadstead, at Funchal, nearly together, after a run of 1,320 miles. The passage-money by these traders is £20, everything being found; children and servants at half that sum. The days of sailing may be seen by reference to the 1st or 2nd column of the *Times* newspaper. The Brazil packet —sailing brig—leaves Falmouth on the 4th of each month, and generally makes a good passage. Another mode of reaching the Island is by going to Lisbon, in the Peninsular and Oriental Company's Steamers; one of which leaves Southampton on the 7th, 17th, and 27th, of each month; and proceeding, thence, to Madeira in the Portuguese schooner, Zargo, or brig, Galgo; but, as it is uncertain how long a passenger might be detained at Lisbon, this is not, by any means, a plan to be recommended to invalids. By far the best and most comfortable way of going out, is in the London packet brigs, which call at Southampton; as these vessels have all been built expressly for this trade, have skilful and obliging commanders, and are especially fitted-up for the accommodation of invalids; who may rely upon receiving every necessary attention.

The only regular opportunities for leaving the Island, for England, are by the four regular trading brigs, unless Lisbon be taken on the *return* route; as neither the West India steamers, nor the Brazil packets, call at Madeira, on their homeward voyage. It is, however, expected that those brigs which ply between England and the Brazils, will be superseded by a new line of steamers; which will call at Madeira, both on their homeward and outward voyage; and, according to the present arrangement, will sail from Southampton on the 1st of each month. The contract for carrying the mails, is already taken by the present Royal West India Steam Company; a circumstance from which it may be hoped that, before the close of this year, a steam communication, to and from the Island, will be established. This will be attended with the most beneficial results, as regards the Island—the various fruits and vegetables of which may meet with a regular demand from the London markets.

With respect to the clothing that passengers take out, no change should be made from that which is usually worn at home; for warm, winter covering is found, at times, as serviceable in Madeira as in our own climate, where we can count upon good fires, and various other comforts, not always at hand elsewhere, when the air becomes inconveniently cold. All articles of furniture, pianos, &c., are allowed to be taken on shore for *eighteen months, free of duty*, on giving a bond at the Custom-house, that if not shipped before the expiration of that period,

the duty will be paid. This is a great boon to the visitors, and one of the wisest regulations ever made by the authorities.

The most advantageous kind of money to take out to Madeira, is that of sovereigns, which, by Royal decree, are now current coin of the Island. Doubloons, if taken out, may bear a profit, as at the Exchange offices, here, they may be, generally, bought at less than their current value. Letters of credit frequently cause a serious loss; as visitors may have to draw upon England, when the rate of exchange is unfavourable. The following money is computed by *reis*. The *rei*, or Portuguese *real*, is an imaginary unit.

MONEY.

20	Reis	...the Vintem ....equal to	0s.	1d.	English.
50	,,	...Half-testoon, or Half-bit .... ,,	0	2½	,,
100	,,	...Testoon, or Bit .... ,,	0	5	,,
200	,,	...Pistarine, or Two Testoons .... ,,	0	10	,,
400	,,	...Crusado.. ,,	1	8	,,
1000	,,	...Pataca, or Milrei—Spanish, United States, or South American dollar........... ,,	4	2	,,
4800	,,	...Sovereign... ,,	20	0	,,
4000	,,	...Quarter-Doubloon .... ,,	16	8	,,
8000	,,	...Half-Doubloon .... ,,	33	4	,,
16000	,,	...Doubloon... ,,	66	8	,,

WEIGHTS.

1 Quintal..................	is	128lbs.		*These weights of Madeira are 4 per cent. heavier than those of England.*
½ ,, ...	,, ...	64	,,	
1 Arroba	,, ...	32	,,	
½ ,, ...	,, ...	16	,,	
¼ ,, ...	,, ...	8	,,	
1 Arratel or Livra	,, ...	1	,,	
½ ,, ,, ...	,, ...	½	,,	

MEASURES.

1 Pipa	is	92	Imperial Gallons.
1 Meia Pipa	,,	46	,,
1 Quartola	,,	23	,,
1 Barril	,,	8	,,
1 Almude	,,	4	,,
1 Canada	,,	$\frac{1}{3}$	,,
$\frac{1}{2}$,,	,,	$\frac{1}{6}$	,,
1 Quartilho	,,	$\frac{1}{12}$	,,
1 Moio	,,	3	Imperial Quarters.
1 Alquire	,,	$\frac{2}{5}$	Imperial Bushel.
1 Vara	,,	$1\frac{1}{4}$	English Yards.
1 Covado	,,	$\frac{3}{4}$	,,

There are two hotels in Funchal; the London Hotel, kept by John Lewis, which has been established a great number of years; and Yates's Family Hotel, a more modern establishment. Boarding houses are innumerable, and are to be met with in every situation, so that the visitor can be at no loss for accommodation. The terms in all the most respectable houses are the same; namely, fifty dollars per month for board and lodgings, inclusive of table wines. It is customary to engage for the season—say six months—on first entering the house; and there is another custom which I should be happy to see abolished, by which, in case of death, at any intermediate period, one-half, or twenty-five dollars per month, is demanded for the remaining portion of the six months. It only requires an example of positive resistance, on the part of friends, and a *custom*, so unscrupulously mercenary, would soon be put an end to. Fifty dollars per month may be considered *dear*, in a place where provisions, vegetables, and fruits are exceedingly *cheap;* but, when

it is taken into account that the season only lasts during the winter months, and that, at all the respectable houses, an excellent table is provided, the charge can scarcely be considered too high. In the suburbs of Funchal, there are numerous quintas, or country villas, to be let, furnished, for the season, at rents varying from £50 to £200 for the six months, according to the size of the house, extent of gardens, and situation. Mr. Samuel Wilkinson and Mr. John Payne have, generally, a list of such quintas and give every information respecting them. Good Portuguese servants may be obtained, at very moderate wages, and many of them now speak English. For a family intending to stay the whole of the season, it is by far the best plan to take a furnished house; not only on the score of economy, but also as regards comfort. The following are about the average market prices, viz.:—

Fish	......60 to	80 reis per lb.—equal to			3d. or	4d.	per lb.	English.
Beef	......60 ,,	65 ,,	,,	,,	3 ,,	3$\frac{1}{4}$	,,	,,
Mutton	...50 ,,	80 ,,	,,	,,	2$\frac{1}{2}$,,	4	,,	,,
Pork	......80 ,,	100 ,,	,,	,,	4 ,,	5	,,	,,
Veal	......80 ,,	100 ,,	,,	,,	4 ,,	5	,,	,,

Fowls ... 3 ,, 4 dollars per dozen.
Ducks ... 4 ,, 5 ,, ,,
Partridges, 800 reis per brace.
Wild Pigeons, 600 reis ,,
Rabbits, 200 to 300 reis per couple.
Peaches, from 10 to 50 for 100 reis.
Apricots ,, 50 ,, 200 ,, 100 ,,
Oranges ,, 100 ,, 200 ,,
Lemons ,, 100 ,, 300 ,,
Bananas ,, 15 to 20 ,, 100 ,,
Melons, 1 for 100 reis.
Wild Strawberries, per quart-basket, 100 reis.
Table Grapes, all kinds, per lb., 60 reis.

The Medical Men practising in Funchal, and here arranged alphabetically, are Drs. Broughton, Imray, Lister, Lund, Millar, Moderno, D'Ornellas, Pitta, A. da Silva, C. da Silva, and Tibbett.

Grocery and Provision Stores, and Bread and Biscuit Bakers.—John Payne, and Wm. and Alfred Wilkinson.

Silk Mercers, Drapers, Hosiers, &c.—Rutherford and Grant, F. Wilkinson and Co., and J. M. Basto.

Chemist and Apothecary.—Mauricio de Andrade, of the Botica dos Dois Amigos.

Livery Stables.—John Sutcliffe.—French Bazar.—Jewellery and all Fancy Articles.

Dr. Andrew Combe, in writing from Madeira, in the winter of 1843, says—"Every day brings forth some fresh proof how much, and how often, invalids damage themselves needlessly, by imprudence or ignorance, and how great is the need of making a general knowledge of our own functions a part of every-day education, and its applications a part of every-day practice.

In truth it makes one sad to see so many examples of every chance of recovery, although sought at such a sacrifice, thrown away by follies of conduct, even on the part of sensible and thinking people. They imagine climate to be everything, and to dispense with all care or precaution on their part.

One approved method of sacrificing health and chances, consists in taking a few days latitude in eating, drinking, and scampering about to see sights, *before* settling down and seeing the doctor, because he will forbid such extravagancies. The excitement of a new scene, carries them through a few days of this; and, while it lasts, they are delighted to find themselves so much better already! The consequence too often is, that at the end of a week, they take to bed, and then send for the doctor, and, when the evil is done, resolve to follow his advice in future. One of the latest arrivals, landed a day or two before Christmas, just when the cold weather set in, acted on the above principle. She began by scampering about, up hill and down dale, on horseback, with some other passengers, and, in a very cold, wet night, went to the *midnight* service at the cathedral. You will scarcely wonder to learn that she has since suffered severely, and now affirms that the climate *does not agree with her.* Another approved form of sacrificing health here, consists, in those who have gained, during the winter, taking a week of scampering and fatigue, before leaving the Island, to see the magnificent mountain scenery, the nearest of which is three hours' fatiguing ride from Funchal, and which it would be strange if they could not *say when they went home* that they had seen; for this is often the motive assigned. I have heard of several who have, in this way, thrown away all the benefit obtained by six or eight months' residence and care. The larger proportion err, apparently, from not

knowing better. They wish to be careful, but cannot tell how. Several hurt themselves by insisting on going twice, every Sunday, to church, although the fatigue and confined air exhaust them so much that they generally spend the two next days on the sofa, or in bed. One young lady, with whom we remonstrated, from its palpably bad effects, would not desist, and affirmed that the air was pure, and the fatigue nothing; but on going, a fortnight after, to the sacrament, an hour after the time of meeting, the vitiated air struck her so much that she nearly lost consciousness, and was soon obliged to leave. From that hour, the fact became evident to her understanding, and she has since abstained.

Explain it how you may, it is the fact, that when the change first sets in, the healthy, as well as the invalids, often growl about the chill air, and often suffer from it, too, in the shape of pulmonary and intestinal affections, of some severity; when, thermometrically, you would pronounce them all a set of discontented grumblers. Some bold spirits, indeed, acting on the conviction of understandings, accustomed to implicit faith in the thermometer, continue to sport their white summer jackets and trowsers, and affirm that it is not so cold as we take it to be; but it is precisely among this class of invalids that I have heard of the heaviest punishments, in the form of catarrh, and other chest attacks.

The climate is complained of, generally, as relaxing, and to this cause is attributed the want of

energy among the people, and the tendency to put up with things as they are, rather than go in search of improvement. There is truth in the statement, but not, in my opinion, the *whole* truth. The climate is somewhat relaxing, from its humidity and equable temperature; and, in summer, must be so to a still greater degree. But so far as I can judge, from my short experience, it is not sufficiently so to account for the results. The great want seems to be that of a mental and moral, rather than a physical, stimulus. Isolated, as the Island is, and out of the influence of all great public questions, affecting the continents of Europe and America, its population lives in an *unmoved*, or quiescent, mental atmosphere; which contributes to apathy and indolence, far more than the merely physical influence of the climate. It is only once or twice a-month that it hears what is doing in the great world; the shock and the impulse given, are dead and gone before the next instalment arrives; and the people feel, moreover, that their feeble voice would never reach any other country, in such force as to be heard. On the Island itself, there is nothing whatever to excite any interest. There is no public principle to discuss—no science to attract—nothing to grumble at, or to amend—except by the round-about way of Lisbon, which rarely gives back even an echo in response. Even, for the trading and busy part of the community, business comes, chiefly, by fits and starts, and is as monotonous as possible. There is no literature—no bookseller's shop—on the whole Island; although a few

books may be had in other shops, but *very few.* With this absolute dearth of wholesome stimulus, how can *the mind* become otherwise than relaxed? And once the mind becomes relaxed and apathetic, I will give any man a dollar who will show it to me associated with a braced and active body. The shoemakers, cabinet-makers, and burroqueros, are a numerous body; and I never saw, anywhere, greater or more unremitting activity, than among these three classes of men, who have all a stimulus to exertion. Among them, one sees nothing of the relaxation complained of. Quite as little is it seen among the workmen, employed in the rivers, or among the peasants, in the vineyards, who feel that their existence and comforts are at stake. Among the English visitors, you find *relaxation* enough, and to spare. But is it wonderful that it should abound in them, even holding the climate guiltless? They are planted down, on a limited space, with nothing whatever to do; with the same scene constantly before them; separated from their ordinary occupations, interests, society, and resources; without anything in the shape of amusement, and often enfeebled by broken health. How, then, can their minds retain their natural vigour, under such a combination of adverse circumstances; let the climate be what it may? The demon of *ennui* becomes the familiar of many of them. A few relieve themselves—especially after a week's residence—by a sustained *roulade* of grumbling; a privilege dear to Britons, and which enables them to bear many heavy burdens. The English reading-

room, with its library and billiard table, is a great resource to the young men. The idle gossip, or play billiards; and the busy, or reading portion, have a choice of an excellent collection of rational and amusing books; although at rather a high rate, namely, fifteen dollars for six months. Gossip, as in all small and idle communities, becomes the chief employment of society; not, by any means, from any peculiar malice in the individuals—who are, collectively, above, rather than below, the average moral stature—but simply as a vent for their mental faculties, which must do something, unless they altogether retire, with Rip Van Winkle, to the Valley of Sleepy Hollow, and spend the period of their expatriation in a pleasing dream."

The truth of Dr. Combe's remarks is so self-evident, that, even without the authority of his deservedly high reputation, it must carry conviction to the mind of every reflecting person. Their substance may be stated in one simple proposition —*An exclusive reliance upon climate is dangerous.* The fact is, that numbers of patients, who, when at home, enjoyed, more or less, the superintendence of medical skill; cast off, upon arriving at Madeira, all solicitude upon that head; until, in consequence of the license, which they give themselves, such symptoms are produced as compel them to apply for that advice, of which, had they availed themselves in the first instance, not only would mischief have been avoided, but a positive progress might have been made towards the arriving at renovated health.

Hitherto, with the exception of the palanquin and hammock, the saddle is the only mode in which the invalid can penetrate into the interior of the Island; and equitation, though, perhaps, the most agreeable species of exercise, is, certainly, not the least fatiguing one; especially on roads where roughness is combined with far more than an ordinary degree of steepness. A frame, relaxed by disease—though in a slight degree—can scarcely count upon deriving benefit from exertion, which taxes even the resources of the healthy. My friend, the late Dr. Gillham—an honourable, liberal, and most kindly man, as well as a most accomplished physician—told me that, although he had resided in Madeira for six years, he had never once visited the Curral, from the apprehension that the attempt might occasion the bursting of a blood-vessel. Patients should guard against giving way to that exhilaration of the spirits, which change of climate, and novelty of scene are calculated to give rise to, and which, too frequently, tempts them to indulge in excursions which, in the same state of health, they would have shrunk from at home. A visit on horseback, to the Curral, a distance of about fourteen miles, is equal to a ride of fifty miles upon an ordinary English road.

In the case of almost every visitor, the monotony of Madeira life is a subject of complaint, and, by many, is found to be intolerable. Some diversity, in this respect, will be effected by the completion of the road from Funchal to Cama dos Lobos. By

this long-wanted improvement, a drive of seven miles out, and characterised by the most imposing scenery, may now be enjoyed; and carriages, drawn by horses, a luxury hitherto unknown, may be soon expected to present the visitor with a rich source of recreation. The two or three vehicles of this description, which have made their appearance in Madeira, have, heretofore, been drawn by oxen. But enterprise, with the brains of science, and the sinews of capital, might accomplish far greater results than the connecting of Cama dos Lobos with Funchal. Easily practicable access might be effected, with reference to every interesting locality; and, perhaps, there is no Island in the world which, in the same compass, presents scenery of such variety, beauty, and grandeur. This, with the turning to full account of, at least, one rich source of more ample irrigation, whereby the present fertility would be far more than doubled, would infinitely enhance the attractions of the climate; would greatly add to the number of stationary residents, and give rise to such a periodical influx of visitors, as in any preceding instance was never experienced, since the world was made acquainted with the sanatory fame of Madeira.

PLATE I.

Showing the mean, and mean maximum temperature, at Sta. Luzia, Funchal, Madeira, for every month in the year; also the mean maximum power of solar radiation above the mean maximum temperature of the shade;—with the mean depression of temperature produced by evaporation: showing the humidity of the climate—1834 and 1835.

PLATE II.

Showing the mean and maximum temperature of London, for every month in the year; also, the mean maximum power of solar radiation above the mean maximum temperature of the shade.

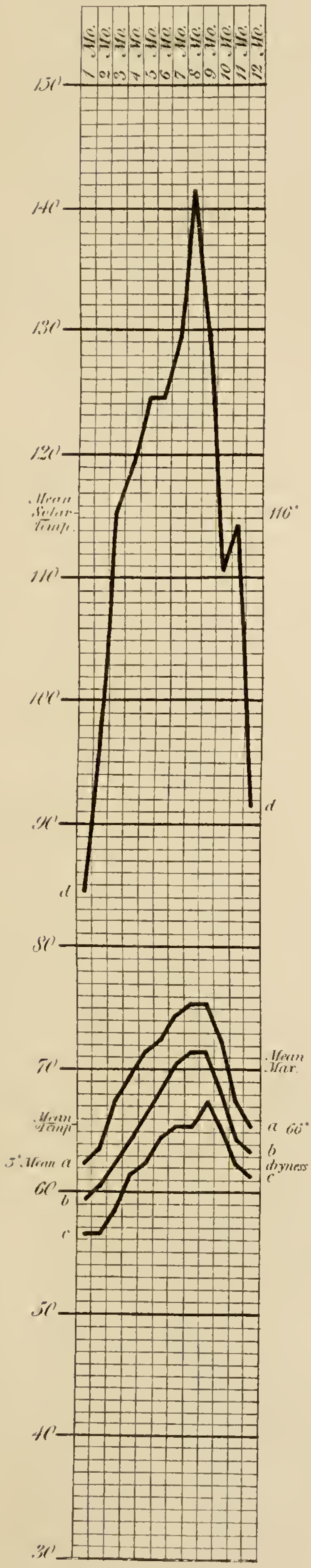
PLATE III.

Showing the height of the thermometer in the shade, and in the sun, on the 3rd May, 1834, Sta. Luzia, Madeira, at the hours indicated—at which time solar radiation was at its maximum,—also, the degree of cold produced by evaporation at the above hours.

PLATE I. PLATE II.

a a Mean Maximum Temperature in the Shade.
b b Mean Temperature in the Shade.
c c Depression of Temperature produced by evaporation.
d d Black-bulbed Thermometer on the Ground shewing the effect of Solar Radiation.

Madeira.



London.

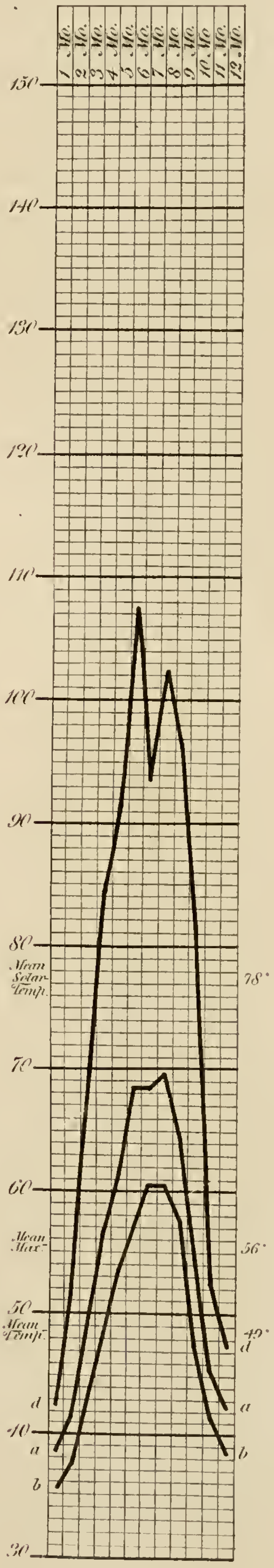
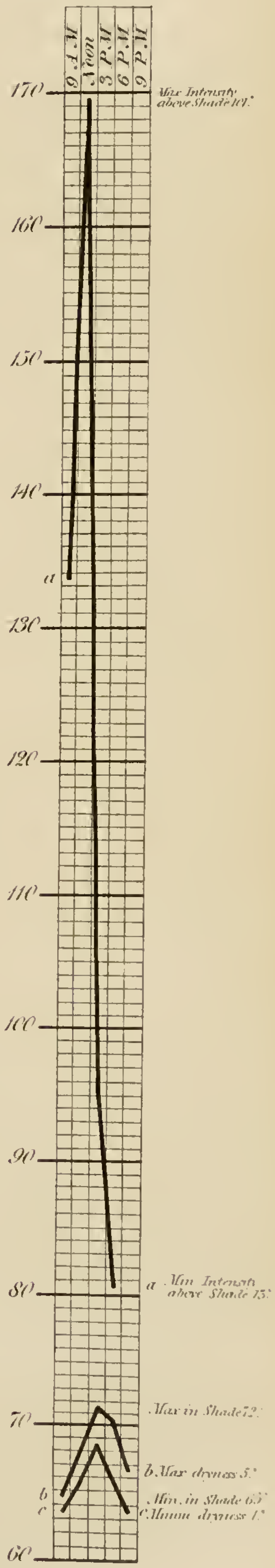


PLATE III.

a a Temp. in the Sun.
b b Temp. in the Shade.
c c Depression of Temp. produced by evaporation.

Madeira.



J. A. Mason. M.D. del

J. R. Isaac. Engr. Liverpool

PLATE IV.

a a Temperature in the Shade.
b b Depression of Temperature produced by Evaporation.
c c Black-wooled thermometer on the ground; showing the effect of Solar and Terrestrial radiation, at the hours indicated in the Table.
d d Naked Thermometer in the air, suspended five feet from the Ground.

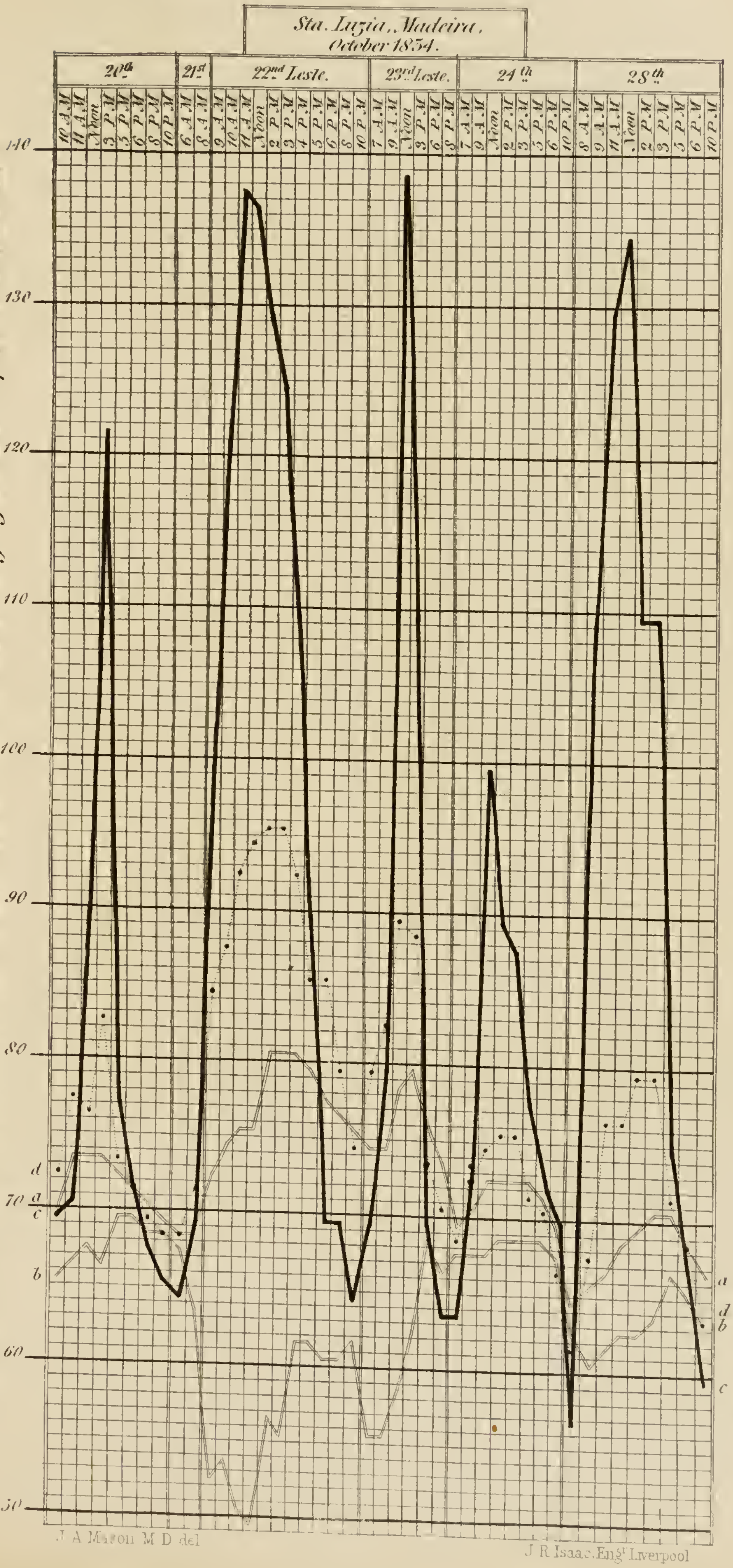


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PLATE IV. *Showing Table LXVI on the linear plan; by which will be more clearly seen, the difference between the Leste, and the ordinary state of the atmosphere. The degree of dryness observed, is calculated from the Temperature in the Shade, for the facility of showing the difference of Refrigeration produced by evaporation; the distance between the double lines indicating the degree of dryness observed: the lines when in contact being regarded as the point of full Saturation.*

N.B. *The Sun's direct rays did not fall upon c and d until ¼ before 9 A.M. or continue later than a little past 5 P.M.*

PLATE V.

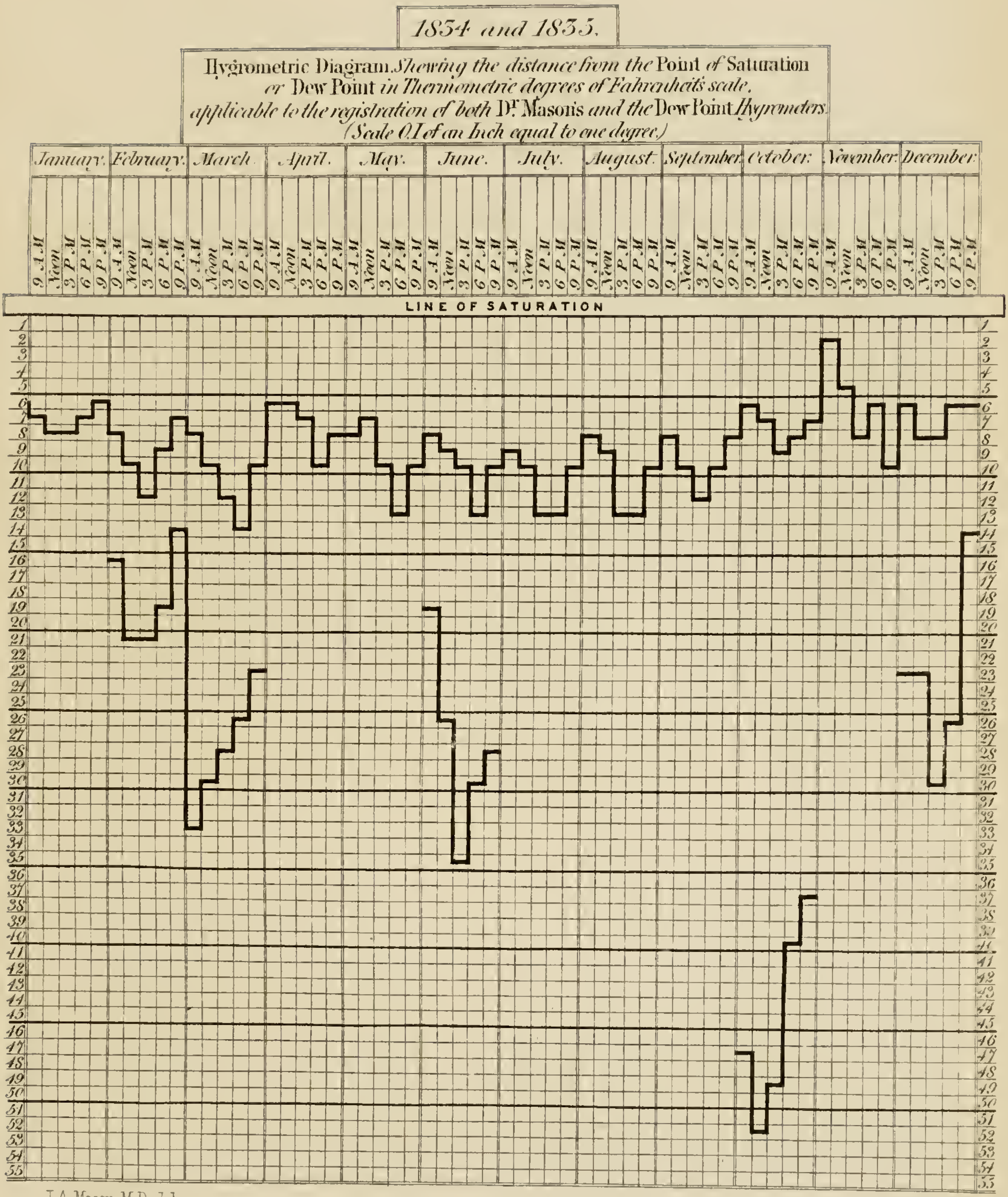

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PLATE V. *Showing the mean degree of dryness on the thermometric scale of Fahrenheit by Dr. Mason's Hygrometer; made equivalent to degrees of absolute dryness at the hours indicated: also the degree of absolute dryness produced by the Leste, in each month when it occurred.*

Sta. Luzia, Funchal, Madeira.

INDEX.

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